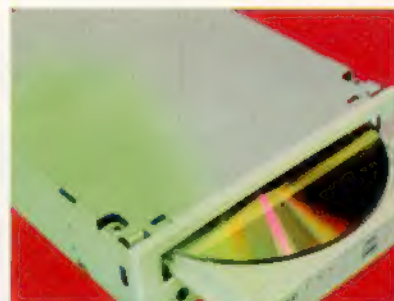


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Who Drives Innovation?



Software innovation was the theme of my previous column. In it, I said a lot of people have noted that the biggest changes happen in niche categories and that major software hasn't really changed. Many blame Microsoft for this trend. The argument goes like this: Microsoft takes the ideas it sees in smaller products and adds them to

its products, notably Windows, reducing the market for those newer products. Therefore, people won't invest in creating these smaller products, or they won't get funding—and as a result innovation is curtailed.

As in all such arguments, there is an element of truth. In the areas where Microsoft is the dominant software vendor—particularly operating systems and office applications—we aren't seeing as much innovation as we once did. But whether that is because Microsoft is so dominant that it has scared off competition or because these categories are more mature is open to debate.

Many of the features added to Windows over the years began as parts of third-party applications. The list includes such things as file managers, Notepad, and even a calculator, as well as disk compression, defragmentation, and file-viewing utilities. We've all profited by such integration. Current iterations of Windows 95 and Windows NT are far from perfect, but they're easier to use and more stable.

Microsoft's biggest achievement may be its ability to add features to its OSs while remaining compatible with the applications and machines that came before. For instance, in Windows 95, Microsoft was able to make the transition to a 32-bit OS while maintaining compatibility with most 16-bit Windows and DOS applications.

This pattern of adding more things into the OS is now becoming more controversial. The current Department of Justice complaint against Microsoft deals with the question of whether Microsoft has "integrated" Internet Explorer into Windows 95 or just bundled the two together. That's more of a legal question than a technical one, so I'll leave it to the lawyers.

But Microsoft is clearly innovative in the way it adds Web browsing to the OS. With programs like Active

Desktop in Internet Explorer 4.0 and Windows 98, Microsoft now lets you view your local or network files in the same way you view the Web.

Do I want more things added to the OS? You bet. I want an OS that is more stable, easier to use and manage, and more scalable. Achieving this will involve integrating some features that are now in other applications or utilities.

How do you draw the line between what should be integrated into an OS and what really should be a separate application or utility? I don't know. It's easy to see that some sort of line should be drawn, but I don't know where.

Will this stop third-party innovation? So far, there's clearly no lack of new utilities being developed. In our next issue, we'll review more than 200.

But the real question is, where is the innovation going to come from? Much of the change we've seen in OSs has been from developers taking ideas that started on larger computers and bringing them down to the PC. That has pretty much run its course; most of the features from the largest systems are now in PCs.

Some innovation has always come from entrepreneurs and smaller companies. We need to make sure there's always a place for them. And of course, some of the innovation has stemmed from studies at large research labs and universities. But most labs are interested more in short-term products than long-term research, and there's less funding for basic research at most schools these days. Microsoft and Intel are now doing more basic research, and that's good, but they also are the companies that stand to benefit most from the status quo.

Still, it seems as if every time computer hardware or software solves one problem, there are newer problems to be addressed. That brings opportunity into the market. And that, I'm sure, will continue to lead to innovation.

A stylized, handwritten signature of Michael J. Miller in black ink.

MICHAEL J. MILLER

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BY ROBERT S. ANTHONY

In case you haven't noticed, these hand-held PCs are everywhere—and this time, they're not likely to do their usual fade from the scene. Why is the idea finally going to catch on for good? Because of one amazing success story related herein that proved the concept in a big (and little) way, plus a proliferating market for applications.....100

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Worlds in Your Hand

Captivated by hand-held computing? At PDAUser (www.zdnet.com/products/pdauser.html), ZDNet's Products Channel offers the latest PDA reviews. PalmPilot fans should visit PalmPilotUser (www.palmpilotuser.com), where they'll find not only the latest Pilot info but also lots of great downloadable software.

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BY NEIL RANDALL

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Get in the Game

BY NEIL RANDALL

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SPEECH RECOGNITION

Watch What You Say

BY ALFRED POOR

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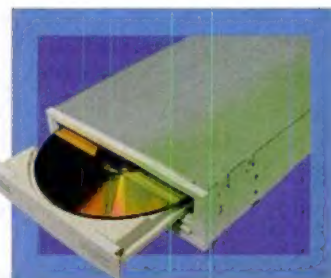
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BY JONATHAN HILL

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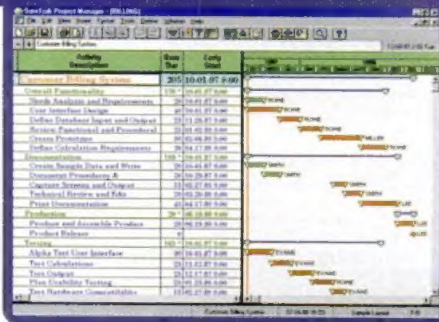
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Apple's Comeback



Steve Jobs has engineered what may be a turnaround at Apple Computer, with strong sales of systems using the company's G3 processor and with new software titles arising from Apple's partnership with Microsoft. Apple has also announced a quarterly profit of \$45 million on revenues of \$1.4 billion.

Jobs noted late last year that Apple would proceed with some aggressive moves in the retail arena, especially at CompUSA. Apple recently reported that 3 percent of CompUSA CPU sales are now for Macintosh systems. Also, 57 pilot Apple "mini-stores" in CompUSA outlets, selling all kinds of Apple products, now produce 14 percent of CompUSA's sales. The company has promised more of the mini-stores this year.

Apple has also made some software announcements. Apple and Microsoft are planning several products that will incorporate many features not found in their Windows versions. Among the extra features in Office 98 for the Macintosh, for example, is drag-and-drop installation, in which you drag one folder to the hard disk icon.

And the company has just released Version 8.1 of its Mac OS. "Mac OS 8.1 improves on Apple's most successful software release to date—Mac OS 8—which was released last July and has sold over two million copies to date," Jobs says. The release includes greatly improved Java performance and faster application launching.

Jobs also recently demonstrated a new upgrade to Apple's multimedia software QuickTime, which incorporates video- and audio-streaming

technology for the first time.

Apple will position Quick-

Time 3.0 as a direct

competitor of RealNetworks' streaming-multimedia products.

Rumors have been flying that there may be a buyer for Apple, and many had expected January's Macworld trade show to include an

announcement of a buyer,

but the show did not include any such

news. The crowd

was far smaller than in previous

years, and other than workstation announcements

from companies such as Digital and Intergraph, there

was a notable paucity of developer interest

in the Macintosh platform.

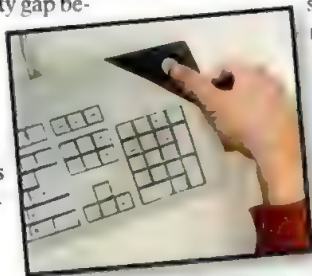
"I can report, I think for sure, that Apple is coming back."



Thumbs Up!

What's to stop an imposter from sitting down at your PC and sending a securely encrypted e-mail message using your digital signature? Nothing. To bridge the security gap between the PC and the person using it, start-up WhoVision—based in Sebastian, Florida—has developed a low-cost fingerprint identification technology that can be built into keyboards and monitors.

A rugged sensor that can



withstand skin's dryness and even scratches measures the electrical field emitted by your fingertip's ridges and valleys, translates it into an image, and compares it to a database of prints. WhoVision has already

signed on monitor maker MAG Innovision as well as a major keyboard manufacturer to build the sensor into future products. According to CEO Alex Dick-

inson, fingerprint identification will eventually secure door locks, house alarms, and basically anything that currently requires a key.

Aerogel and Xerogel

Researchers at Rensselaer Polytechnic Institute in Troy, New York, are creating a chip insulator called aerogel—a substance so porous it's more air than solid material—which, they say, could more than double computing speeds.

Good insulators let chip designers place interconnects—the minuscule system of wires and insulation carrying messages between transistors—close together without slowing down the electrical signals. Air, the perfect

insulator, has a so-called dielectric constant of 1.0. But you can't hold chips together with air. Silicon dioxide, the material now used on most chips, rates at about 4. Aerogel dips as low as 2.5.

Meanwhile, Texas Instruments has demonstrated a substance called xerogel, which is made of microscopic glass bubbles containing air. It estimates that within a decade, combining xerogel with copper wires could result in chips that are 10 times faster than today's.

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Pipeline

The Year 2000 Bug's Bite

With roughly 500 business days to go before January 1, 2000, it may seem that everything that can be said about the "Y2K bug" has been said. Yet sharp disagreements about the scope of the software crisis remain.

At the high end, Software Productivity Research estimates a total cost of \$3.6 trillion; at the other end of the scale, British investment firm BZW estimates direct costs of \$52 billion, less than 2 percent of SPR's figure. Granted that these numbers are not directly comparable, they show that a great deal of uncertainty remains among the experts.

Stepping into this fray recently, William McDonough, president of the Federal Reserve Bank of New York, sounded a wake-up call to the international banking industry. "The centu-

ry date change poses a very significant risk for financial markets," he said. He pointed out that security software is not exempt from the problem and that updating and testing it must not compromise banks' security. "Failure to get it right," he said, "will affect the integrity of the payments system and the performance of the domestic and maybe even the global economy."

Meanwhile Edward Yardeni, chief economist for Deutsche Morgan Grenfell, has said that the Y2K bug—"a trivial yet overwhelming problem"—increases the probability of a 20 percent drop in the stock market. Such a drop could, depending on its global scope, add trillions of dollars to the Y2K price tag and spark a sharp economic downturn all by itself.



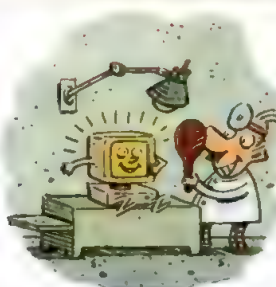
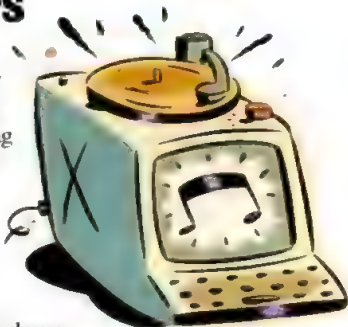
Web Mixmasters

You may like Mariah Carey's latest single, but do you really want to pay for the whole album just to enjoy one song? A growing number of online record stores don't think you should have to, and they're continuing to discover new ways to turn the Web into the world's most flexible music distributor.

Last year, N2K started selling downloadable stereo-quality song files at its site, Music Boulevard (www.musicblvd.com). The cost? Just 99 cents per song. You download a special player called e_mod, which decodes the files and even helps you to burn your own custom-made CDs if you have a CD-R drive.

The latest custom-CD competitor is CDuctive (www.cductive.com), which takes a slightly less immediate approach. Specializing in cutting-edge dance music and hard-to-find European electronica imports, the site lets you select up to 72 minutes of music, which it then puts on a CD and mails to you. The first song costs \$7.99, and each additional song costs 99 cents.

Not sure what you want? Preview one of CDuctive's ready-made compilations or listen to the current top ten before you buy.



Web Face-Lift

One of the driving forces behind the rise of the Web has been the unanimous acceptance of HTML (HyperText Markup Language), and the World Wide Web Consortium (W3C) has announced the release of the next version's specification. HTML 4.0 is intended to lead to widespread adoption of what's likely to be the Web's universal publishing language.

"Insisting on HTML 4.0 compliance now will preserve your free choice of suppliers of Web software, tools, and applications well into the future," says Tim Berners-Lee, the W3C director and the inventor of the Web. According to Berners-Lee, the new specification is meant to "make the Web more appealing, more accessible, and more international."

So what's new and different? Version 4.0 calls for improved forms, tables, frames, and scripts, in addition to support for style sheets and advanced objects. HTML now lets Web authors produce multilingual documents. It also supports the rendering of table and form text into Braille, making the Web more accessible to users with disabilities.

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Source: Computer Intelligence Data for November 1997.

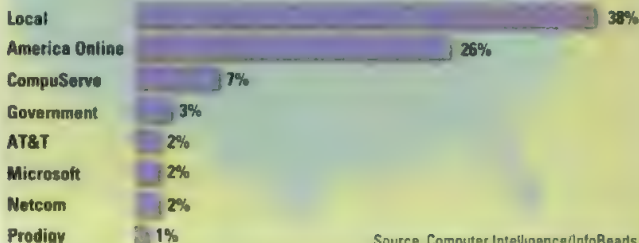
Tech Combo

In a move intended to lower the cost of owning a PC and to ease enterprise management, Intel and Platinum Technology have signed a joint licensing agreement to combine their technologies. Intel will invest in Platinum and license parts of Platinum's enterprise-management database solution. Platinum will gain rights to Intel's LANdesk Configuration Manager, which sends software updates over a network.

Platinum's ProVision automates a broader set of tasks, including those for system performance management, security, and database management.

Local ISPs Bring In the Business

More than 30 percent of all U.S. businesses are connected to the Internet, and they're mainly choosing small, local Internet service providers. But America Online has secured a strong position, boosted by small businesses needing only links to the Web, not e-commerce or intranet services.



Source: Computer Intelligence/InfoBeads.



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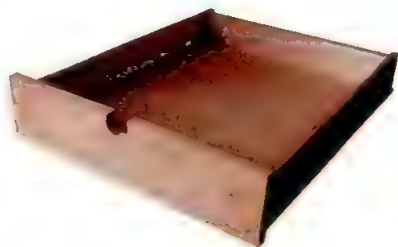
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Letters

UP IN ARMS OVER THE YEAR ZERO

It's about time that a bit of common sense was injected into the year-2000 debate. Jake Kirchner's comments in "Bugged by the Year 2000" in the January 6, 1998, issue were refreshing. Just because nobody designated a year zero doesn't mean that there shouldn't have been one. It should have been the year that preceded year one. Most words are defined or redefined by common usage, and if the majority of people decide that the new millennium starts on January 1, 2000, then that is when it starts.

RAY KNIGHTS
Phoenix, Arizona

To say that the new millennium doesn't start until January 1, 2001, is absolute stupidity. Any person who thinks that would believe anything. That is like saying that your first penny is not part of your first dollar. No, maybe there wasn't a year zero. But there was a day one. That day one was a part of the first year, which was a part of the first decade, which was part of the first millennium. The current millennium includes day one, just as the second millennium will include its first day. And that first day will begin at 12:00:01 on January 1, 2000.

THOMAS MORRIS
via the Internet

I couldn't agree more with Kirchner's response to the millennial debate. There may be some argument as to when the tenth decade of the 20th century ends, but there can be none as to when the nineties decade will end. As Kirchner points out, this is a matter of social convention, not math. As far as I'm concerned, the millennium starts on January 1, 2000.

JON MURPHY
Englishtown, New Jersey

WHERE'S THE JUSTICE?

It's unfortunate that the Justice Department has decided to come to the aid of crybabies who can't compete in the free marketplace. The problem is not that Microsoft is too good; the problem is that its competitors are so bad. As a network support specialist, I benefit every day from the high standards Microsoft sets. In my opinion, the American public is without a doubt benefiting from Microsoft's business practices. Government meddling will only serve to make my job more difficult and set a new, lower standard for all software-publishing companies.

JOSEPH W. SZARMACH
via the Internet

I do not know why the media, along with the government, are so focused on the Microsoft Internet Explorer integration issue. This kind



"When the new millennium starts is a matter of social convention, not math."

of issue debuted when Microsoft Windows 95 arrived. Back then, Microsoft was trying to integrate The Microsoft Network. And you know what? It did. Now the MSN icon appears by default on Windows desktops. Why didn't AOL and CompuServe complain then?

SAAD AHMED
via the Internet

I disagree with the Justice Department's attack on Microsoft. As a user of Microsoft Windows 95, Windows NT 4.0, and Internet Explorer 4.0 as well as Netscape Navigator 4.0, I am puzzled and annoyed by all this nonsense. I feel that the DOJ is wasting taxpayers' money. The integration of IE 4.0 and the Windows OS is entirely within the user's control. Most important, having IE 4.0 installed on my machine does not in any way, shape, or form force me to use it or prevent me from using Netscape Navigator. Did anyone in the Justice Department try these products?

CHAUN SANTORIELLO
via the Internet

MONITOR SOLD SEPARATELY

Perhaps I am missing something here, but it seems to me that buying a computer that is advertised as being less than \$1,000 ("Right at Home," December 16, 1997) but requires the separate purchase of a monitor is like buying a car with only three wheels. What good is that? Do these companies really think that consumers are stupid enough to believe that they are getting the entire machine for under \$1,000, when in fact the price will be well above that mark? I get a chuckle from the ads, which proclaim in bold letters that the advertised PC is

priced under \$1,000—and in letters almost too small to read tell you "Monitor sold separately."

HENRY S. WINOKUR
Bethesda, Maryland

IF THE PC FITS...

In his January 6 column, Bill Howard ("Ten Trends for 1998") states: "Now a lot of people fear every PC becomes obsolete quickly, so why spend more? I still think there are serious drawbacks to sub-\$1,500 computers, but the buyers have spoken." From personal experience, I'd say one reason for the appeal of the sub-\$1,500 system is that most users never use the full processing capabilities of a Pentium MMX/200. Computer shoppers today are wiser and know that most of the hype generated by Intel and Microsoft is hot smoke. Most of my clients realize that a sub-\$1,500 PC fits their needs and that the computer industry talks down to purchasers.

PETER LIN
via the Internet

MMXed OUT

I was upset although not surprised to see Intel's MMX technology given a Technical Excellence Award (The 14th Annual Awards for Technical Excellence," December 16). MMX is the most overhyped, entirely trivial hardware advancement of 1997. It seems that Intel's annoying and flashy ads, which are noticeably devoid of any real substance, have hooked the *PC Magazine* staff along with thousands of uninformed consumers.

AARON J. BARNES
via the Internet

TALKING TAPE

I was delighted when I saw the First Looks article on tape drives for PCs ("A Tape Restoration," January 6), but two pages into the story, I could see that the focus was on Travan technology and not at all on total cost. It would have been useful if you had addressed and compared the different types of tapes and explained why Travan tapes are so expensive relative to 8-mm tapes.

DUANE MATTERN
via the Internet

Your article on backing up data implies that there are people out there who have 2GB, 4GB, or even 6GB of useful data to back up on their systems. Has anyone done a survey to find out how much useful data is stored in the average computer? If I had to guess, I'd say less than 100MB. Your readers would be better served by an article on how to maintain their files in such a way as to make backups simple and efficient. Of course, in a nation where most garages are full of junk that will

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or to locate a Canon dealer in your area, visit our Web site at www.ccsi.canon.com or call us at 1-800-848-4123.

See what we mean."

Canon

Letters

never be used, maybe it makes sense to make tape backups of junk files that will never be used.

W. R. AYERS
via the Internet

DVORAK'S WINTER CLEANING

I just want to thank John C. Dvorak for the great tip ("Winter Cleaning Dept.") in the January 6 Inside Track column. The instructions for flushing the cache used by Internet Explorer are a gem. That procedure freed up a lot of space on my hard disk.

BOB LINDINGER
Schenectady, New York

LAPTOPS VS. DESKTOPS

Dvorak, in his January 6 discussion of laptops versus desktops ("The Japanese Invasion"), overlooks some important facts. First, laptops are facing new competition from specific-use products such as PDAs. Many consumers are finding they don't need to take a desktop replica on the road. It may be important for a writer like Dvorak, but the average businessperson needs only the ability to send and receive messages and to be able to access a PIM. Second, laptops are experiencing further competition in the mobile arena from Windows CE hand-held PCs.

Third, with the recent introduction of hard disks with capacities from 10GB to 15GB, laptops are hard-pressed to keep pace from the standpoints of price and bang for the buck. Fourth, businesses are requiring more and more interconnection. Laptops require expensive network hubs. It will be difficult for laptops to compete with the alternative of network computers, and laptop hardware cost is

CORRECTIONS AND AMPLIFICATIONS
The January 20 After Hours article "College Prep, 1998 Style" was written by Brett Krasnove. In the same story, the phone number given for Kaplan Educational Centers should have been 800-527-4836.

We neglected to credit Sam Ward for his illustration in the January 6 Trends article "Roll-Up Displays" (page 28).

The original release of Microsoft Windows 95, referred to in "Solving the Mysterious Save Password Problem" (December 2, 1997), is not the same version as OSR1 (OEM Service Release 1). OSR1 incorporates the first Microsoft Service Pak, which contains fixes to the original release. To install the updated Windows 95 components mentioned in the article, first check which version of Windows 95 you have: Select My Computer on the desktop, right-click, and choose Properties. If your system is Version 4.00.950, you have the original release. If it is 4.00.950a, you have OSR1. If it is 4.00.950b, you have OSR2. If you have the original release, you should install the Service Pak 1 update, followed by the Enhanced Password Cache Security update. If you have OSR1, you should install only the Enhanced Password Cache Security update. If you have OSR2, you should not install either, since they're both already installed.

still much higher than the unit cost of interconnected, networked PCs.

MICHAEL SOLOMON
via the Internet

Dvorak (January 6) writes, "Another [computer] is an Atari outfitted with a Video Toaster module, which I seldom have time to play with." I'd love to play with one, too, considering how difficult it must have been to fit an Amiga Video Toaster card into an Atari computer. Humor aside, I agree with Dvorak. Although I don't need a laptop for travel, I am considering one for home use. I want to be able to move my PC from the guest room to the dining room to the sofa, something that isn't practical with a desktop system.

MICHAEL LOADER
via the Internet

HANSON FAN OFFENDED

I am 13 years old, and my father subscribes to your magazine. I was offended by your obscene, immature picture of one of the most appreciated and best-known bands in the world: Hanson ("The Best of Abort, Retry, Fail?", January 6). Everyone is entitled an opinion, but your picture of Hanson's heads on a shish kebab skewer is juvenile.

KATIE GREENE
via the Internet

KASPAROV FAN OFFENDED

In "The Best of Abort, Retry, Fail?", you say that Gary Kasparov gave "lame excuses" for his loss to IBM's Deep Blue computer. As both a computer enthusiast and a tournament chess player for five years, I feel obligated to correct this false statement. If there was any show of poor sportsmanship, it came from IBM. First, IBM's CEO claims he came to see "the greatest chess player in the world and Gary Kasparov." Then, after the match, IBM refused to grant a rematch—even though Kasparov granted IBM a rematch when it lost the previous year. To say, as you did, that he was "trounced" is an insult and an exaggeration. I

also resent the implication that artificial intelligence is now a reality. That is no more possible than stirring chemicals together in a test tube and creating life.

JEFFREY C. BRANDT
via the Internet

BORDERING ON MUZAK?

I am worried by Bill Machrone's column "Beat Those Winter Blues" (December 16), especially by his statement urging users to "make music, with the help of your computer." I do understand that the column was really about using the computer as a learning tool. But after seeing untrained people in the "Music for Nonmusicians" seminars, I'm more convinced than ever that making music on a computer is a contradiction in terms. Aids such as G-Vox train you to look instead of listen.

JOAN BULL
via the Internet

MYSTERY SOLVED

A thousand thanks for the article "Solving the Mysterious Save Password Problem" (PC Tech/Operating Systems, December 2). It demystified everything else I have ever downloaded from the Web.

BILL MOY
Simi Valley, California

DISCOVERING TRAVEL WEB SITES

Your review of Internet travel reservation sites ("Travel Web Sites: Be Your Own Travel Agent," January 6) was very informative. In the past I've used Expedia and Travelocity to compare rates, then called the airline to book the flight. This time I ordered a ticket from Expedia and booked a flight on Kiwi with my Discover card. The site apparently accepted my reservation. A week later, I received a message from Expedia saying that Kiwi does not accept Discover. The Web site should have supplied that information at the time.

DENNIS BRONSTEIN
Chicago, Illinois

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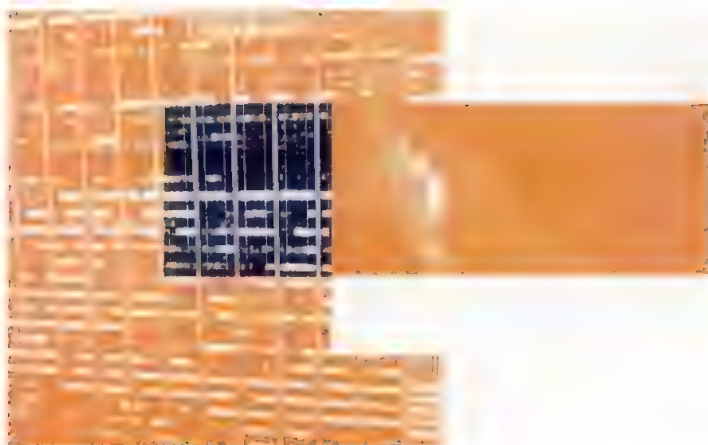
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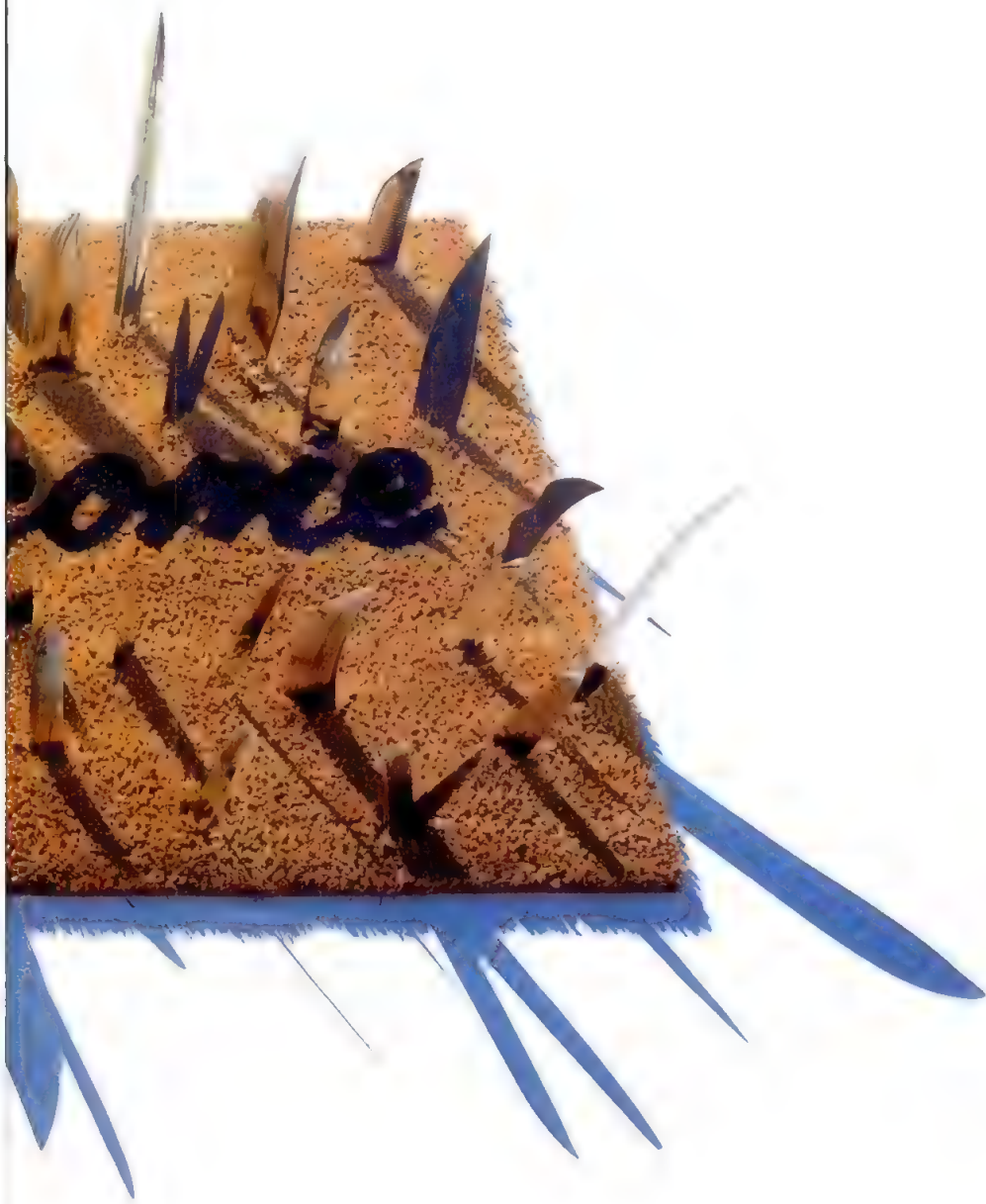


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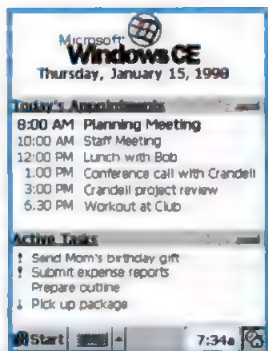
Microsoft is out to take the operating system Windows CE 2.0 in some new directions. The company recently revealed the designs for two new Windows CE 2.0 platforms. The Palm PC will compete head-to-head with 3Com's PalmPilot, and the Auto PC is designed for automobile dashboards. The first products on sale for both platforms are expected in the spring.

The Auto PC and Palm PC provide a glimpse of Microsoft's long-term plans to extend computing in traditional applications, such as personal information management, and in arenas where consumers haven't yet accepted computing, such as cars. A raft of third-party software and peripheral vendors were on hand during the announcement at the Consumer Electronics Show in Las Vegas, to show support for Microsoft's reference designs and to tout their own applications of the technologies.

WINDOWS IN YOUR PALM...

The Palm PC—code-named Gryphon—gives Microsoft a shot at the market for hand-held computers without keyboards, currently dominated by the PalmPilot. This Windows CE reference design includes voice recording, infrared communications, natural-handwriting recognition (as well as support for "electronic ink," which saves handwriting as an image), support for CompactFlash cards, and a back-up battery, which keeps you from losing data while changing main batteries.

Standard applications include Pocket Outlook, voice and text notes, a clock, a calculator, and solitaire. Manufacturers that have announced Palm PC models (expected to cost from \$300 to \$500) include Casio, FIC (Everex), LG Electronics, Philips, Samsung, and Uniden.

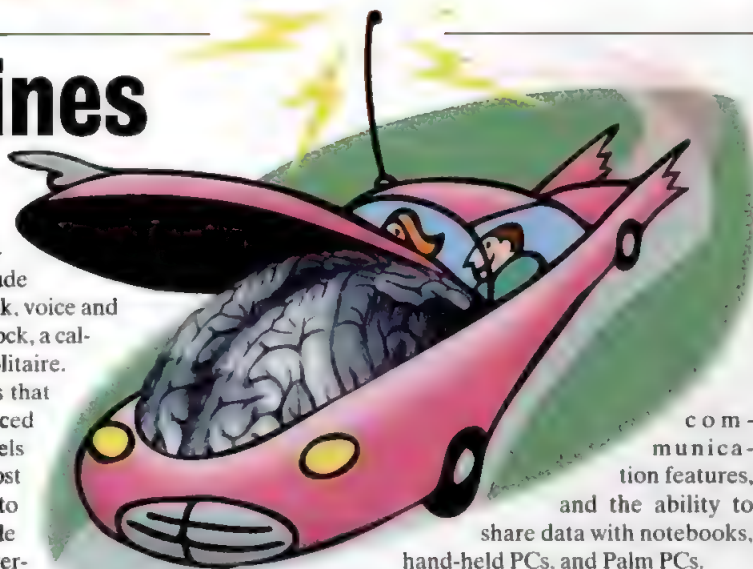


BOOKED UP: The Palm PC takes on the PalmPilot.

... IN YOUR CAR ...

The Auto PC—code-named Apollo—fits inside a standard dashboard radio slot, so retrofitting existing cars is easy. With safety being everyone's top concern, Microsoft has announced Active Talk technology, which allows you to control the Auto PC while keeping your hands on the wheel and your eyes on the road.

The design includes an AM/FM radio, a CD player, a digital equalizer, access to personal information, driving directions, and wireless communications such as paging, e-mail, and traffic alerts. You activate all of them by voice. The Auto PC will have a USB port, infrared



communication features, and the ability to share data with notebooks, hand-held PCs, and Palm PCs.

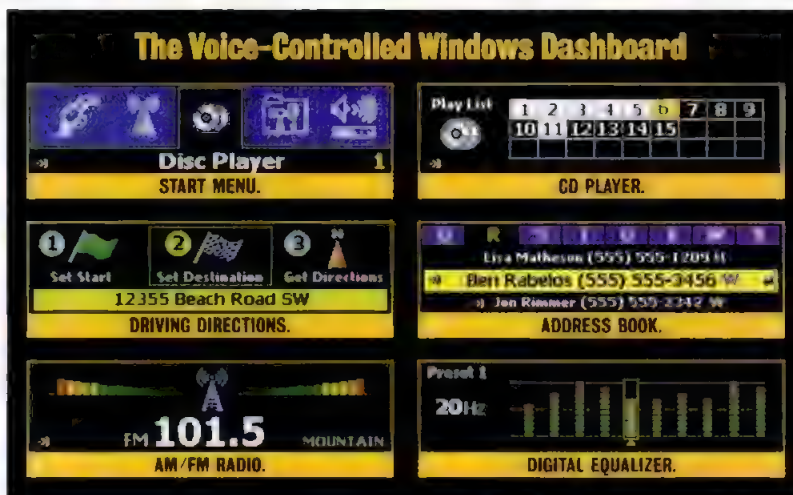
A number of audio manufacturers have announced plans to develop Auto PCs, including Alpine, Harmon Kardon, and Visteon, a Ford division. Clarion expects to sell the first units in April, with prices to range from \$1,200 to \$2,500, depending on options (such as integrated cellular telephony, Global Positioning System, and compact disk changer). In the third quarter of this year, Ford and Infiniti buyers will be able to buy Auto PCs as dealer-installed options.

... AND IN YOUR CLOTHES?

Microsoft isn't finished yet with new Windows CE platforms. The Palm PC and Auto PC join the Handheld PC as hardware reference designs, giving manufacturers a starting point for further enhancements. Other applications of the scalable 32-bit Windows CE are anticipated during the next two years. Microsoft and cable giant Tele-Communications (TCI) recently inked a deal to outfit with Windows CE 5 million of the 12 million digital set-top boxes that TCI expects to roll out early next year. And there are rumors that Windows CE will run in pens and watches and even that it will be woven into clothing.

The Palm PC is a logical platform for Microsoft and the company's partners, and the Auto PC is a potentially exciting new application. But look for Windows CE to appear in a wide range of other devices during the next few years.

—Bruce Brown



Illuminating Flat-Panel Experiment

Invisible light brightens LCDs.

The race is on to make LCD panels brighter and more power-efficient. Today, desktop and notebook LCD panels are at a disadvantage compared with traditional CRT displays. Unlike the light-emitting phosphors at the surface of a CRT, the layers of an LCD selectively block the light coming from a backlight. Even when displaying a white screen, an active-matrix LCD panel lets as little as 5 percent of the backlight illumination through.



let light. When this light strikes colored phosphors at the front of the screen, the phosphors are excited and emit light.

This approach has a number of benefits. Since the phosphors emit light, as in a CRT, the image is viewable from a wide angle. And because there are colored phosphors at the surface, there's no need for light-absorbing color filters. Also, by using a specific wavelength for the backlight, engineers can design more efficient polarizing filters than they can with the broader spectrum of white light.

Researchers say these improvements could result in a panel that's 50 percent more power-efficient than a traditional LCD. Potential gains in other areas, such as reflected-light recovery and improved backlights, could make PL-LCDs three times as efficient as today's LCDs. That could mean lighter weights, brighter images, and increased battery life.—*Alfred Poor*

Researchers at Cambridge University's engineering department and at Screen Technology, in England, are experimenting with a new design that they call *photoluminescent liquid crystal displays*, or PL-LCDs.

Like a traditional LCD, this design uses a layer of liquid crystal cells to act as shutters that can block or transmit backlight illumination. But instead of using visible light, the backlight emits invisible ultraviolet light.



Stress Testing with WebBench 1998

WHEN WE BEGAN PLANNING OUR ANNUAL Web server roundup for our issue of May 5, 1998, we turned to the Ziff-Davis Benchmark Operation (ZDBOP) to deliver an updated WebBench benchmark test program. Last year's effort—WebBench 1.1—was effective, but we wanted to test with bigger workloads that would reflect the traffic at Web sites of varying sizes.

After the ZDBOP engineers looked at log files from several major Web sites and created a new workload, PC Labs tested the servers. We discovered dramatic differences in the way Microsoft and Netscape servers allocate system RAM as a file cache—differences that significantly affect performance. Along the way, we came up with some tricks for improving server performance.

The cache allocation algorithm of Microsoft Internet Information Server (IIS) is scalable through the addition of RAM. Netscape's default installation, however, is neither scalable nor tunable, and for large Web sites it doesn't take advantage of the cheap RAM that you've

long it takes to respond to users.

When we tested Microsoft's server software with our benchmark test program, the server allocated about 25 percent of available system RAM to file-cache operations. This proportion held true for varying amounts of system RAM, from 64MB to 512MB. The server's performance is directly tied to system RAM: If you increase the RAM, you increase the cache and usually increase the system throughput.

When we tested Netscape Enterprise Server, we found that it used a fixed 10MB cache regardless of the amount of system RAM. The performance curves for Netscape were similar whether our server had 64MB or 512MB of system RAM.

When we compared the preliminary test results, we saw that these two products drastically differed in their performance curves. We went back to Netscape and asked the developers why they had decided to fix the amount of cache used by the Web server. In Netscape's opinion, the 10MB default is sufficient in most cases, with the

TUNE-UP With the default cache for Netscape Enterprise Server 3.0 fixed at 10MB, the system does not take advantage of available RAM. With a utility that you can download now from Netscape's Web site, you can tune the cache and improve performance significantly.

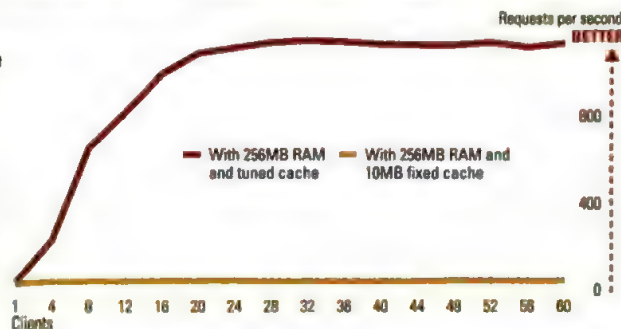
put into your server. Our testing led Netscape to make its cache-tuning utility publicly available.

In order to match closely the work that major Web sites do, we significantly changed our WebBench workload. For 1998's version, we created a workload of approximately 6,000 files of various sizes, totaling about 60MB of Web page data. In comparison, last year's workload was about 2.5MB. This increase lets us stress a Web server as we observe how well it manages the files in its cache and how

only exceptions being very large sites and benchmark-test tuning.

Netscape Enterprise Server includes a utility, *perfdump*, that lets you track and modify performance tuning. Before we began our investigations, this utility was undocumented and unavailable to most users of Netscape servers. But after our conversations, Netscape put the instructions for tuning the server on its Web site. The utility is now available at help.netscape.com/kb/server/971211-7.html.

—Steve Buehler



Intel Cubed

A new 3-D graphics chip is a first for Intel.

Imagine going on an interactive 3-D tour of the Vatican's Rooms of Raffaello, wandering around and zooming in to admire the intricate details of the School of Athens frescoes. How will you do it? You'll use real-time rendering, which is poised to be one of the hottest technologies to arrive on the desktop this year. A CD-ROM called *Raffaello Stories*—from Italy's InfoByte SPA—is one of the first to show off Intel's first graphics chip, the Intel740, which specializes in accelerating 3-D scenes and video playback.

Intel teamed up with Real 3D, a spin-off of Lockheed Martin—which is a longtime developer of real-time computer image generation and 3-D technology for the military—to develop a high-powered graphics accelerator for the mass market. Launched in February, the Intel740 combines several techniques that promise to drive the development of interactive photography, immersive environments,



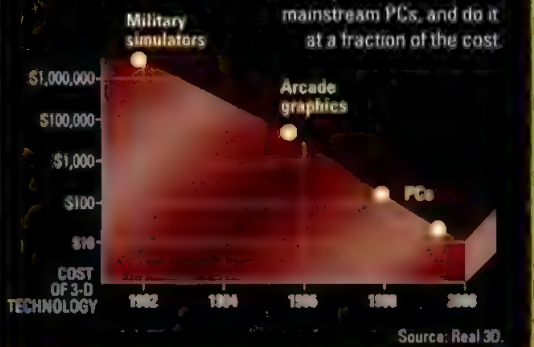
3-D business applications such as data visualization, and, of course, a new generation of 3-D games. The architecture combines parallel data processing, which allows the queuing of several commands at once, and precise pixel interpolation, for delivering precise color and image quality. And with the aid of the Advanced Graphics Port, the chip supports direct memory execution, which lets large amounts of textures that would overflow frame-buffer memory be stored in system memory and quickly retrieved by the graphics accelerator, for quick rendering.

In addition to contributing to the technology, Real 3D is one of the first vendors to have developed an Intel740 board. Its StarFighter is named after the Lockheed F-104 StarFighter, the first aircraft to fly at twice the speed of sound. ASUSTek, Diamond, Number 9, and STB are also developing boards.

Intel, however, is going up against intense

Enabling 3-D

The Intel740 graphics chip is designed to bring the same advanced 3-D technology used in military simulators down to mainstream PCs, and do it at a fraction of the cost.



competition in the market for 3-D chips. ATI, Matrox, Number Nine, Rendition, 3Dfx, and 3DLabs are among the dozens of companies with 3-D chips of their own.

With the industry moving full-speed ahead in developing 3-D hardware and apps, the technology is likely to be mainstream within the next few years. According to market analyst Jon Peddie, "By the year 2000, 99 percent of all computers will be 3-D-enabled."

—Carol Levin

JAKE KIRCHNER

PC Prices: How Low Can They Go?

For years I've argued that price is the key to increased consumer PC sales. I know that sounds like a no-brainer, but most systems and hardware vendors have insisted that the major reason market penetration was stalled at less than 50 percent of U.S. households was because PCs are just too gosh darn hard to use. Now, with fully outfitted PCs selling for less than \$1,000 and with their pricing continuing to drop like a stone, we'll finally get to see who's right.

For several years the number of U.S. households with computers has been running about 40 percent to 45 percent. But penetration is now about 65 percent for households with high incomes, and it's almost 70 percent for households with annual incomes exceeding \$100,000. I for one don't believe that people with high incomes are necessarily more capable of operating computers than the rest of the world, which is why I say the ease-of-use issue is overblown.

There's a huge market of well-educated Americans with annual incomes between \$25,000 and \$50,000 who use computers at work, have children at home, and exhibit the other characteristics of home computer buyers. Yet the penetration for this group is less than 50 percent, according to Computer Intelligence, which supplied the figures quoted here (for more information, see www.ci.infobeads.com). According to CI, to attain in this huge, underserved market the kind of penetration you find among affluent households, the computer industry will have to start offering attractively featured PCs at prices starting at about \$720.

Compaq and Hewlett-Packard plan to sell just such machines.



These "ultra-affordable" PCs are so attractive that they'll even start cracking the corporate market, according to some analysts (including our columnist Jim Seymour, who discusses that aspect in this issue).

Aaron Goldberg, CI executive vice president and well-known pundit, notes that one reason these systems are so attractive is that even though they're not the most powerful systems on the market, they can run just about all the current software. "The simple fact is that the software environment has not changed in 18 months," Goldberg says. "A classic 166 Pentium runs everything on the market or 95 percent of it, so consumers feel okay about buying the low end, because it doesn't go obsolete quickly as it used to."

This raises the key question facing computer vendors and users today: How low can the costs drop? And what will be the practical implications for vendors and users when quality PCs, including monitors, can be purchased for less than \$600—a price we should hit within a year? Even with manufacturing advances, these price cuts mean lower profits for vendors and suggest further market share concentration in the hands of a few major players.

As for buyers, I continue to predict we'll see a growing number of moderate- and low-income households obtaining their first PCs this year. But with so much of the profit taken out of these transactions, who will be able to pay for the research to make computers more reliable and easier to use? Consider that VCRs cost today about one-tenth of what they did when first introduced but haven't gotten one whit easier to program. I hate to think the same will happen to PCs.

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SERVERS

For Small Business, Too

Servers are not just for big businesses anymore. Even if your company needs a server but its size doesn't warrant a system on the level of a multiprocessor enterprise server, there are now solutions targeted at you. Acer America, AST, and NEC are all currently offering affordable, expandable server products catering to the ever growing number of small businesses desiring collaborative, file/print, and Internet/intranet solutions.

Acer America Corp. expands its series of dual-capable CPU servers with the **AcerAltos 930** (800-733-2237, www.acer.com). With pricing starting at \$3,200 (street), this midrange server offers your choice of either a 233-MHz or 266-MHz Intel Pentium II processor with either 32MB or 64MB of SDRAM. There's also an AGP port, a 20X CD-ROM drive, a 4MB SGRAM graphics adapter, a standard floppy disk drive, an integrated Adaptec UltraWide SCSI and 64-bit controllers, a PCI 10/100 Ethernet network card, and sufficient expandability. The system memory can be expanded up to 512MB, and there's room for an additional CPU. Further expansion is offered by the four PCI slots, two ISA slots, two 5.25-inch front-accessible drive bays, and four internal drive bays.

On the software side, Acer provides several management and utility tools, including the company's own Advanced Server Management Professional and Remote Diagnostics Manager. All Acer servers receive a three-year warranty that offers on-site service.



SERVERS UP NEC's Express5800 ES1200 (above) and AST's Premium GS (right).

To round out its Premium series of servers, AST Computer (800-876-4278, www.ast.com) has three Pentium II configurations of dual-processor enabled **Premium GS Servers** available: a 233-MHz model with a 4GB hard disk priced at \$3,580 (street), a 266-MHz model with 4GB priced at \$3,920 (street), and a 266-MHz model with a 9GB disk that starts at \$4,480 (street).

Designated as an entry-level server line, these systems each come equipped with UltraWide SCSI hard disks, 32MB of SDRAM (512MB maximum), a 1MB VRAM Cirrus graphics adapter, and a 24X CD-ROM. With the Adaptec 7880 UltraWide SCSI and the Intel 10/100Base-T Ethernet controller integrated on the motherboard, the GS user has plenty of room for

expansion: There are six 3.5-inch internal drive bays, two free 5.25-inch external drive bays, four PCI slots, and one ISA slot.

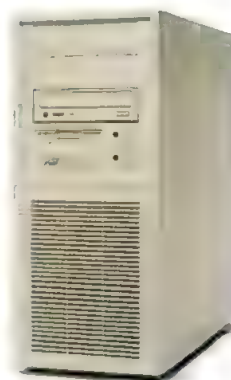
The Premium GS also offers extensive manageability via Intel LANDesk software, a three-year warranty, next-business day on-site response, and 24-hour, 7-day-a-week toll-free and online technical support. If you need a little more power and storage, AST provides myriad upgrade options, such as extra memory (32MB DIMM for \$225), hard disks (4GB for \$875), and processors (233-MHz for \$820 and 266-MHz for \$1,040).

Targeted at offices that need to serve no more than 25 clients is NEC Computer Systems Division's built-to-order server, the Pentium-II based **Express5800 ES-1200** (888-863-2669, www.nec-computers.com). Unlike the Acer and AST systems, the Express5800 ES1200 cannot accommodate a second processor, but it does provide other handy features at eye-

catching prices. The server comes standard with 32MB of RAM (512MB maximum), a 24X CD-ROM, a 3.5-inch floppy disk drive, an integrated ultra-wide SCSI, an integrated 2MB SVGA graphics controller, six expansion slots (four PCI and two ISA), seven free drive bays, NEC's ExpressBuilder software for configuration and installation, and NEC's server management software Esmpo, Version 1.2.

Beyond the standard offerings, you can choose from a wide range of configurations running the gamut from a \$1,869 (direct price) 233-MHz PII system with 32MB of RAM and no hard disk to a \$4,577 (direct price) PII 300-MHz system with 128MB of RAM, a 4GB Ultra-Wide SCSI hard disk, an SMC 10/100 Ethernet adapter, and Windows NT Server 4.0.

All NEC Express5800 servers include a three-year warranty with on-site service and 24-hour, 7-day toll-free technical support.—Angela Tuka



In the Palm of Your Hand

Move over, Palm Pilot—3Com's trendy handheld device is in for competition with the announcement of Microsoft's Windows CE Gryphon platform. And one of the first companies to show a Gryphon-based product is Philips Mobile Computing Group (888-367-8356, www.mobile.philips.com).

Due out this spring, the Philips Nino 300—priced at \$400 (street) with 4MB of RAM, the Nino serial port dock, and carrying case—is a pocket-size device that's a little larger and a little thicker than the Palm Pilot. But its slightly larger size is more than compensated for by the Nino's expanded feature set and larger viewable screen. Designed with an ergonomic contour that's comfortable for one-handed use, the Nino measures 3.41 by 5.25 inches, weighs about 7.33 ounces with two AA batteries, and features a 320-by-240 pixel backlit

touchscreen in 16 shades of gray. The unit is powered by a 32-bit MIPS-based, 75-MHz embedded processor drive and will be expandable and upgradeable via CompactFlash and ROM expansion slots. Several applications are integrated into the Nino, including Pocket Outlook, which offers a calendar, contacts, tasks, and in-box support. And for the connected, there's e-mail, messaging, and information services.

The included dock automatically syncs your Nino with your desktop. Pen input supports both Electronic Ink and Graffiti.

The higher-end model (\$500 street price) also comes with 8MB of RAM, an integrated 19.2-Kbps soft modem (all models are modem-enabled), a nickel hydride rechargeable battery, and an intelligently designed voice recorder.—Melissa J. Perenson



LANGUAGE SOFTWARE

Parlez-Vous Anything?

Trying to learn a new language can be a challenge. Using a software package—such as the products below—to learn a foreign language can turn that challenge into a fun experience, thanks to enhanced multimedia features and local cultural flavor.

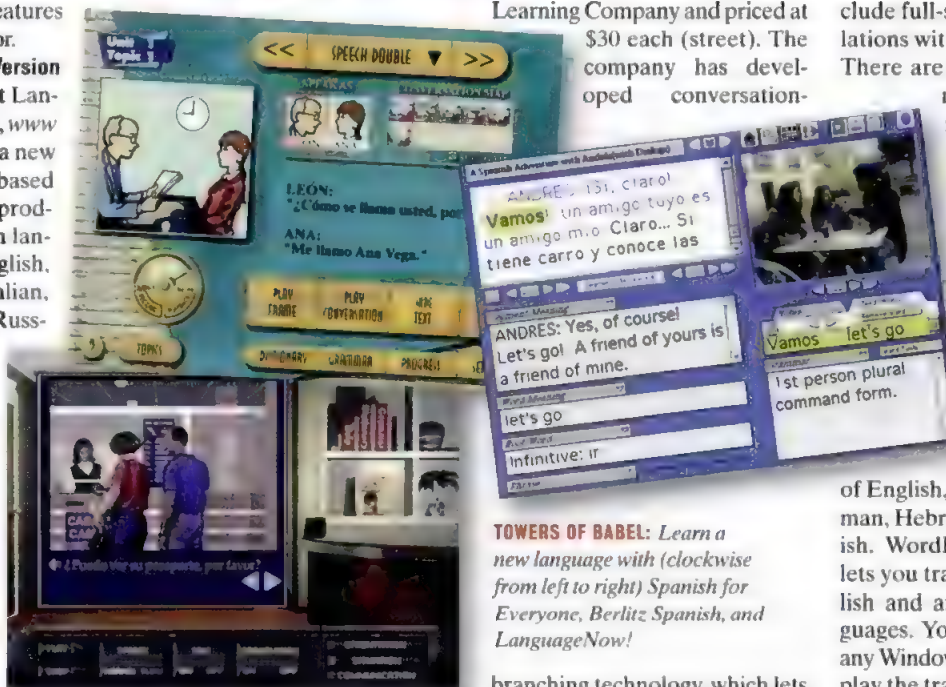
LanguageNow!, Version 6.0, from Transparent Languages (800-332-8851, www.transparent.com), is a new series of computer-based language-learning products. Available in ten languages—Dutch, English, French, German, Italian, Latin, Portuguese, Russian, Spanish, and Swedish—the new version comes with guided conversation practice, a simplified interface, and instant pronunciation feedback and analysis.

The package provides multimedia learning aides, including video dialogues and illustrations of common words, phrases, and cultural icons. There are translations and pronunciations of more than 10,000 to 15,000 words in each of the languages. For beginners, there's a reference guide that introduces characters of a language's alphabet and provides native pronunciations of each letter's name and core sound.

The LanguageNow! series includes four titles: Most Common Words and Expressions, Survival Phrases, Language Adventure, and Video Cultural Experience. The Master Program is \$50 (street); the Plus Edition, designed for the education market, is \$90 (street). Other titles—in areas including literature, nonfiction, culture, business, current affairs, and travel—are \$30 to \$50 (street).

In addition, the Learning Company and Berlitz Interna-

tional have collaborated on a new series of CD-ROMs. **Berlitz French**, **Berlitz German**, and **Berlitz Spanish** (800-227-5609, www.learningco.com) are available for \$50 (street). They present



tion technology evaluates responses and provides feedback. Students can check their progress, since the programs keep track of units and topics completed.

French for Everyone, **German for Everyone**, **Italian for Everyone**, and **Spanish for Everyone** (800-227-5609, www.learningco.com) are programs produced by The Learning Company and priced at \$30 each (street). The company has developed conversation-

learning, and feedback. The speech-recognition feature understands, evaluates, and helps improve pronunciation. And the record/playback technology lets users compare their pronunciations to those of native speakers.

Each program automatically adjusts to users' skill levels, and flexible options let users work at their own pace. The products include full-screen real-life simulations with multiple outcomes. There are 20 movies featuring native speakers in real-life situations as well as hundreds of sound clips, photos, and illustrations.

Accent Software International (800-694-4050, www.accentsoft.com) has introduced **WordPoint 1.0**, a real-time interactive dictionary for on-the-fly translation

of English, Dutch, French, German, Hebrew, Italian, and Spanish. **WordPoint** (\$24.95 direct) lets you translate between English and any of the other languages. You select a word from any Windows application and display the translation in a ToolTip balloon or WordPoint window. You can either click with a mouse or simply hold the cursor over the word to display the translation. It is also possible to enter words manually for translation. The translations work in either direction: English into a foreign language or a foreign language into English.—*Sharon Nash*

TOWERS OF BABEL: Learn a new language with (clockwise from left to right) Spanish for Everyone, Berlitz Spanish, and LanguageNow!

branching technology, which lets users practice conversations by interacting with on-screen characters in simulated situations. The interactive lessons have users speaking the language from the very beginning, with the goal of preparing you for common real-life situations.

The on-screen tutor provides one-on-one instruction, tips for

content in small segments, and there are hundreds of vocabulary and pronunciation activities from which to choose. Users can listen to native speakers pronouncing words from real-life dialogues and can then record their own voices to compare. The advanced speech recogni-

Getting It Right

If you use your word processor for writing documents in Spanish, then take a look at **Machina Sapiens' El Corrector**, an advanced Spanish grammar checker (888-619-9223, www.machinasapiens.com). This package—designed by Spanish linguists—detects all grammatical and typographical errors, and it has a customizable 70,000-word Spanish dictionary that's based both on the standard usage defined by Spain's Real Academia Espanola and on Latin American usage. The program also recognizes various dialects and colloquialisms that have evolved in Spanish-speaking

regions around the world. Not only does the program check verb conjugation, but it also recognizes and corrects accent errors and explains common pitfalls and usage errors within the context of a sentence.

As an added bonus to English speakers, one option lets you display the program's interface and help bubbles in English.

Although the program is compatible with Microsoft Word, Corel WordPerfect, and Lotus Ami Pro, El Corrector can be fully integrated into Word 97.

—*Melissa J. Perenson*



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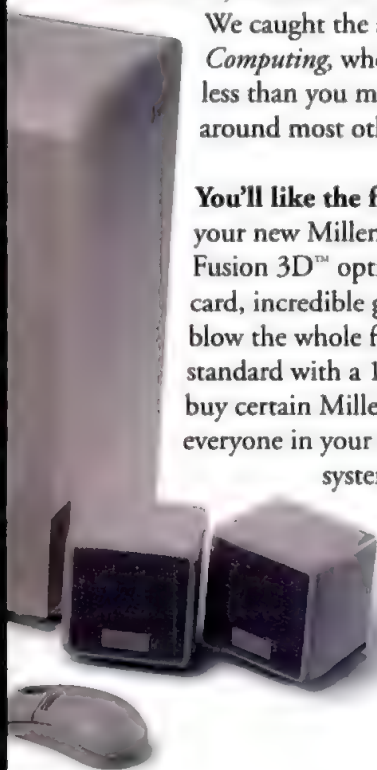
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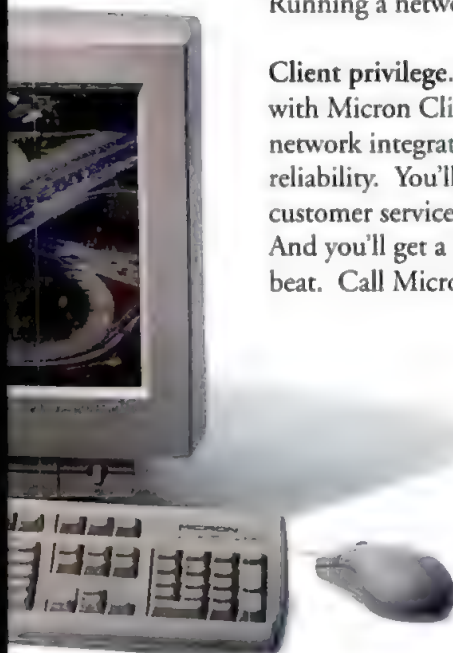


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Power and grace. The Micron™ Powerdigm™ is the definitive workstation for the most astute user. Using Micron's own engineered Samurai™ chip set, the Powerdigm XSU offers the perfect balance of performance, power and value. So perfect, in fact, *PC Magazine* named it the 1997 Workstation of the Year. The Powerdigm XSU "is simply the fastest, most powerful PC I've ever used — the most exciting PC on the planet," says *PC Magazine* guru Jim Seymour.

The logical choice. With more than 400MB per second throughput, rendering drawings and CAD applications is faster than ever. Business finance or high-end applications are incredible, too. With Micron's own Samurai core logic, the Powerdigm workstation delivers 64-bit 66MHz PCI bus, in a system based on Intel architecture and supports dual monitors.

Hard work pays off. None of our competitors even come close. You'll only get this kind of power and performance with the Powerdigm workstation, and you'll get the support and service that comes with the Micron name. Get the Powerdigm. It's a Micron masterpiece.



Business Solutions

NetFRAME® LV2000

Intel 233MHz Pentium® II processor
32MB ECC SDRAM
2GB Ultra Wide SCSI-3 hard drive
Microsoft® Windows NT® Server 4.0 (10-user license)
NOS support (3 incident resolutions/1st year), 7x24

STANDARD FEATURES

Single or dual Intel Pentium II processors
512KB integrated cache in SEC package
ECC SDRAM option (4 DIMM slots)
5 expansion slots: 4 PCI, 1 ISA
Integrated Adaptec PCI Ultra Wide SCSI-3 controller
Intel EtherExpress™ Pro 100 NIC
12X SCSI-2 CD-ROM drive
10 drive bays: 4 external 5.25"/1 external 3.5"/
2 internal 5.25"/3 internal 3.5"
Intel LANDesk® Server Manager v.2.8
Dedicated server technical support, 7x24
5-year/3-year Micron Power™ limited warranty
1-year next-business-day on-site service*

\$3,499

Bus. Lease \$119/mo.

NetFRAME MV5000

Intel 300MHz Pentium II processor
64MB ECC SDRAM
4GB Ultra Wide SCSI-3 hard drive
Microsoft Windows NT Server 4.0 (10-user license)
NOS support (3 incident resolutions/1st year), 7x24

STANDARD FEATURES

Single or dual Intel Pentium II processors
512KB integrated cache in SEC package
Memory: ECC EDO or SDRAM option
9 expansion slots: 6 PCI, 2 ISA, 1 shared ISA/PCI
Dual integrated Symbios Ultra Wide SCSI-3 controllers
Intel EtherExpress™ Pro 100 NIC
Embedded RAID upgrade option
I/O ready via embedded Intel i960-RD
5 internal, hot-pluggable, hard drive array bays
(Upgradable to 10)
1 (one) 360 watt hot-pluggable power supply standard
(Upgradable to 3 for added redundancy)
Rack Adapter Option
Intel LANDesk Server Manager v.2.8
Dedicated server technical support, 7x24
5-year/3-year Micron Power limited warranty
1-year next-business-day on-site service*

\$5,699

Bus. Lease \$181/mo.

*On-site service for NetFRAME LV2000 and MV5000 server is provided by Digital Equipment Corporation and is optional.

**Price excludes monitor.

ClientPro VXE

Intel 166MHz Pentium processor with MMX technology
Microsoft Windows NT Workstation

\$1,149**

Bus. Lease \$40/mo.

ClientPro MRE

Intel 233MHz Pentium processor with MMX™ technology
32MB SDRAM
2.1GB SMART Ultra ATA hard drive
15" Micron 500Lx, .28dp (13.7" display)

512KB pipeline burst cache, DMI compliant,
2MB flash BIOS
Network adapter with Wake-On-LAN technology
24X ATAPI variable speed CD-ROM drive
S3 ViRGE graphics accelerator, 2MB EDO RAM
Intel LANDesk Client Manager available
Advanced hardware monitoring and power management features
Chassis intrusion alert
Microsoft Windows NT Workstation
5-year/3-year Micron Power limited warranty

\$1,599

Bus. Lease \$56/mo.

ClientPro 766Xi

Intel 266MHz Pentium II processor with MMX technology
64MB SDRAM
3.2GB SMART Ultra ATA hard drive
17" Micron 700FGx, .28dp (16" display)

512KB internal L2 secondary cache, DMI compliant, 2MB flash BIOS
32X ATAPI variable speed CD-ROM drive
Network Adapter with Wake-On-LAN technology
4MB AGP 3D video
Creative Labs SoundBlaster™ 16 soundcard w/speakers
Microsoft Windows NT Workstation
Intel LANDesk Client Manager available
Advanced hardware monitoring and power management features
Chassis intrusion alert
5-year/3-year Micron Power limited warranty

\$2,399

Bus. Lease \$84/mo.

Call now to order.
888-224-4151
www.micronpc.com



Configured For Your Life™

Portable Solutions

Micron TransPort XKE

STANDARD FEATURES

512KB pipeline burst cache
128-bit, 2MB DRAM graphics
20X CD-ROM drive with AutoPlay™ technology
Pick-a-Point™ dual pointing devices
16-bit stereo sound and microphone
56K fax/modem * ††
Dragon NaturallySpeaking Personal voice recognition software
CardBus and Zoomed Video
2 infrared ports, S-Video, NTSC, game USB ports
Mobile Software Solutions
2 Modular expansion bays
Custom nylon carrying case
Microsoft® Windows® 95 and MS® Plus!
Microsoft Office 97 Small Business Edition
5-year/1-year Micron limited warranty

Micron TransPort™ VLX

166MHz Intel Pentium processor with MMX technology
16MB EDO RAM (40MB max.)
1.6GB hard drive
16X modular CD-ROM drive
Li-Ion battery
12.1" TFT SVGA, 800x600 display
256KB L2 pipeline burst cache
PCI bus with 128-bit graphics accelerator
MPEG compatible
Zoomed video-ready
Touchpad pointing device
Microphone and 16-bit stereo sound
2-way infrared port
Modular floppy drive
Microsoft Windows 95 and MS Plus!
5-year/1-year Micron limited warranty

\$2,249

Bus. Lease \$79/mo.

Micron TransPort XKE 233

233MHz Intel Pentium processor
with MMX technology
64MB EDO RAM
3GB removable hard drive
13.3" TFT XGA display

\$4,199

Bus. Lease \$133/mo.

Extended VLX Portable Service Options

2nd and 3rd year parts and labor; 3-business-day turnaround for 3 years¹	\$269
2nd and 3rd year parts and labor; 7-business-day turnaround for 3 years¹	\$209

Micron TransPort XKE 266

266MHz Intel Pentium processor
with MMX technology
64MB EDO RAM
5GB removable hard drive
13.3" TFT XGA display

\$4,599

Bus. Lease \$146/mo.

TransPort Options

VLX Options: Motorola Montana 33.6 fax/modem, Dragon NaturallySpeaking Personal voice recognition software, 3Com PCMCIA ethernet adapter, 10-Base-T, custom nylon carrying case, Samsonite leather carrying case, 2nd Li-Ion battery, 2.1GB primary hard drive upgrade, 8MB EDO RAM upgrade (24MB total), 24MB EDO RAM upgrade (40MB total)

XKE Options: Microsoft Windows NT 4.0, MicronDock™ multimedia port replicator with hot docking and built-in battery charger, Micron Executive™ desktop package: matching black monitor, mouse and keyboard, PCMCIA Ethernet adapter, 10/100 Base-T, leather carrying case upgrade, 2nd modular lithium-ion battery, primary and secondary modular HDD upgrade options up to 5GB, memory upgrade options up to 192MB, auto/air adapter, Multimedia Xcitement Pak

Call now to order.
888-224-4151
www.micronpc.com



Configured For Your Life™

Performance Desktop Solutions

Millennia® MME 166

Intel 166MHz Pentium® processor
with MMX™ technology
32MB SDRAM
3.2GB Ultra ATA hard drive
15" Micron 500FGx, .28dp (13.7" display)

STANDARD FEATURES

512KB pipeline burst cache, flash BIOS
Integrated 100MB Iomega Zip drive, 3.5" floppy drive
24X EIDE variable speed CD-ROM drive
32 voice wavetable stereo sound with speakers
3Com/US Robotics 56K x2 telephony modem*
PCI 64-bit 3D video, MPEG, 4MB EDO DRAM
Microsoft® IntelliMouse™, USB connections
Microsoft Windows® 95 and MS® Plus!
Microsoft Office 97 Small Business Edition
Choice of one Micron Software Solutions Pak
5-year/3-year Micron Power™ limited warranty

\$1,599

Bus. Lease \$56/mo.

Intel 200MHz and 233MHz Pentium processors with MMX technology configurations also available.

Micron Software Solutions Paks

Quicken Financial Suite '98: Quicken Deluxe, Parent's Guide to Money, Quicken Financial Planner, Quicken Family Lawyer†

Home Productivity Pak: Compton Interactive Encyclopedia, Broderbund Print Shop Ensemble III, Crayola Magic 3D Coloring Book, Mindscape Mavis Beacon Teaches Typing, Creative Multimedia, The Family Doctor, Net Nanny†

EdVenture Pak: Creatures by Mindscape, Freddi Fish 2 by Humongous Entertainment, Schoolhouse Rock by Creative Wonders, Reader Rabbit: Kindergarten by The Learning Company, Dr. Seuss Green Eggs and Ham by Broderbund†

Arcade Pak: X-Wing vs. TIE Fighter, Need For Speed 2, Command and Conquer: Red Alert, 4 button game pad†

Fusion 3D Option Pak

DVD-ROM,** DVD software
DVD PCI decoder card
AWE 64 ISA sound card, Cambridge MicroWorks:
2 speaker satellite with subwoofer stereo system
Fusion 3D game pak: Mech Warrior 2: Mercenaries
D3D version, AH-64D Longbow, U.S. Navy Fighters
'97, Command & Conquer, Formula 1 D3D version
Microsoft SideWinder Pro joystick

Available only on
Millennia XKU systems

XKU Add \$449

Millennia XKU

STANDARD FEATURES

82440LX chip set
512KB internal L2 cache, 2MB BIOS
Integrated 100MB Iomega Zip drive, 3.5" floppy drive
32X EIDE variable speed CD-ROM drive
32 voice wavetable stereo sound,
Advent 009 speakers with subwoofer
3Com/US Robotics 56K x2 data/fax modem*
Diamond Viper V330 128-bit 3D video
with 4MB SGRAM
Microsoft IntelliMouse, USB connections
Microsoft Windows 95 and MS Plus!
Microsoft Office 97 Small Business Edition
Choice of Micron Software Solutions Pak
5-year/3-year Micron Power limited warranty

Millennia XKU 266

Intel 266MHz Pentium II processor
(features MMX technology)
32MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,249

Bus. Lease \$79/mo.

Millennia XKU 300

Intel 300MHz Pentium II processor
(features MMX technology)
64MB SDRAM
6.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,499

Bus. Lease \$87/mo.



Millennia XKU 333

Intel 333MHz Pentium II processor
(features MMX technology)
64MB SDRAM
8.4GB Ultra ATA hard drive
17" Micron 700FGx, .26dp
(16" display)

\$2,799

Bus. Lease \$96/mo.

DVD drive with decoder card add \$199.

*Maximum transmission speed of up to 56Kbps when downloading data and 33.6Kbps when uploading. However, actual performance is dependent upon numerous factors and observed transfer rates may be less than the maximum potentials.

**The CD-ROM drive will be removed upon the purchase of the DVD upgrade.
Available only on Millennia systems with Microsoft Windows 95

Software upgrade may be required to achieve maximum transmission speeds. Software upgrades are available for download from Micron's Web page for free (www.micronpc.com)

Workstation Solutions

Other Systems Options

Powerdigm™

FEATURES AND OPTIONS

Supports dual processors
Supports IDE Ultra ATA and multiple Ultra Wide SCSI-3 hard drives
512KB pipeline burst cache, flash BIOS
Memory upgradeable to 1GB ECC SDRAM
3Com Fast EtherNet 10/100 PCI network adapter
12/20X variable speed SCSI CD-ROM drive
Optional support for dual monitors
DMI, software and hardware management support
Wavetable stereo sound with speakers
Microsoft® IntelliMouse™
Microsoft Windows NT™ Workstation
5-year/3-year Micron Power™ limited warranty

Powerdigm Xsu

Intel 300MHz Pentium® II processor
Samurai™ chip set
Fire GL 1000 pro 8MB 66MHz PCI Open GL
Professional 3D accelerator
4GB Ultra-Wide SCSI-3 hard drive
64MB ECC SDRAM
19" Hitachi SuperScan CM751
(18" display) .26dp monitor

\$4,699

Bus. Lease \$149/mo.

Powerdigm Xsu

Dual Intel 300MHz Pentium II processors
Samurai chip set
128MB ECC SDRAM
Fire GL 4000 15MB 3DRAM/16MB CDRAM
4GB Ultra-Wide SCSI-3 hard drive
Iomega 1GB Jaz SCSI drive
21" Hitachi SuperScan CM801
(20" display) .26dp monitor

\$8,308

Bus. Lease \$263/mo.

Multimedia Options

Cambridge speakers	\$299
Advent AV370 Powered Partners stereo speakers with subwoofer	\$199
Microsoft SideWinder™ 3D Pro joystick	\$59
AWE 64 ISA sound card	\$75

Storage/Media Options

Adapter: 2940U with Ultra SCSI	\$175
Plexor 12/20 Plex SCSI internal CD-ROM drive	\$100
*upgrade from system with standard IDE CD-ROM drive	
Iomega Jaz SCSI drive with 1GB removable cartridge	\$299
Iomega Zip IDE drive with 100MB removable cartridge	\$99
Iomega 6-pack of 100MB Zip cartridges	\$99
Sony 4/8GB SCSI DDS-2 tape backup drive with tape and software	\$899
Seagate TR-4 4/8GB IDE tape backup w/software	\$239
Seagate TR-4 4/8GB SCSI tape backup w/software	\$279

Display/Video Options

19" Hitachi SuperScan CM751 (18" display) .26dp color monitor	\$300
21" Hitachi SuperScan CM801 (20.0" display) .26dp color monitor	\$650
Number Nine Revolution 8MB video card	\$249

Software Options

Small Business Essentials: QuickBooks, Visio, Norton AntiVirus, Astound, Focal Point, American Yellow Pages	\$179
CorelDRAW™ 7 (full retail version)	\$299
Corel WebMaster Suite (full retail version)	\$99

Printer Options

HP Deskjet 692C	\$269
HP Deskjet 890Cxi	\$429
HP LaserJet 6Lxi	\$399
Lexmark 1000 Color Jetprinter	\$140
Lexmark 2030 Color Jetprinter	\$179
Lexmark 7200 Color Jetprinter	\$399
Lexmark Optra E+ Laser printer	\$399
Epson Stylus Color 600	\$269
Epson Stylus Color 800	\$399
Canon BJC - 80	\$299
Canon BJC - 250	\$149
Canon BJC - 4300	\$199
10ft. IEEE-1284 Printer Cable	\$ 16

Communication Options

33.6 external data/fax modem	\$299
56Kbps technology modem*	\$99
56Kbps x2 telephony modem*	\$119

Server Extended Service Options

2nd and 3rd year next-business-day on-site service coverage ¹	\$99
4-hour response ² on-site service coverage ³ (8am - 5pm, M-F), 3 year	\$798
4-hour response ² on-site service coverage ³ (24 hours, 7 days per week), 3 year	\$998
Other service options may be available. ask your system consultant	

Extended Desktop Service Options

Optional 1st year on-site service ¹ coverage included	
2nd year on-site service ² coverage	\$79
2nd and 3rd year on-site service ² coverage	\$99
Other service options may be available. ask your system consultant	

Network Options

3Com 3C509B Etherlink III ISA combo network adapter	\$79
3Com 3C905 EtherlinkXL PCI combo network adapter	\$99
3Com OfficeConnect Hub 8/TCP	\$149
3Com OfficeConnect Switch 140	\$969

Other Options

APC Per7T surge suppressor	\$39
APC Pro7T surge suppressor	\$59
Microsoft Natural Keyboard (upgrade from standard keyboard)	\$49

¹ Requires SCSI host adapter.
² Upgrade from systems with standard Micron 17" 17GA color monitor.
³ 1st year on-site service is available in the United States and in limited areas in Canada from third-party service providers per customer's agreement with provider.
⁴ 2nd year and 3rd year offerings are available in the United States only. Extended services, if purchased after on-site shipment may have a higher cost.
⁵ Service will be scheduled whenever possible, for the next business day after parts are received by the customer.
⁶ Available in certain locations. ask your system consultant for details.
⁷ Some options and accessories available with system purchase only.

*Maximum transmission speed of up to 56Kbps when downloading data and 33.6Kbps when uploading. However, actual performance is dependent upon numerous factors and observed transfer rates may be less than the maximum potentials.



5-year limited warranty on microprocessors and main memory.
3-year limited parts, on system assembly, 1-year full replacement systems.
24-hour on-site service agreement by Micron, 24-hour and remote systems.
30 days of free Micron support in-house support for Micron desktop systems, 3 optional research support up to 100 hours included for Micron server systems.
30-day money back policy.
24-hour technical support.
The foregoing is based on and qualified by Micron's standard, third warranties and terms and conditions of sale. Terms and conditions of sale may vary by region and configuration. Copies of the limited warranties may be obtained on our Web site or by calling Micron.

Micron Sales Hrs: Mon-Fri 6am-10pm, Sat 7am-5pm, Sun 10am-5pm (MT)
Technical Support Available 24 Hours A Day, 7 Days A Week
Toll-free from Mexico: 95-800-708-1755
Toll-free from Canada: 800-708-1758
Toll-free from Puerto Rico: 800-708-1756
International Sales: 208-893-8970
International Fax: 208-893-7393

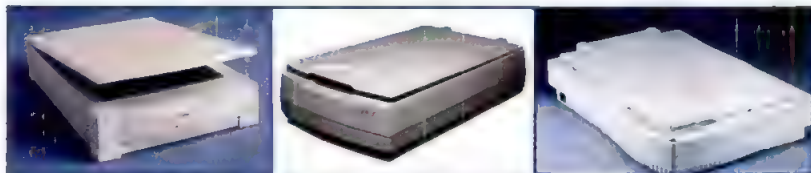
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Trends Peripherals



AFFORDABLE FLATBEDS: The latest scanners from (left to right) Canon, Microtek, and Plustek.

COLOR FLATBED SCANNERS

Capture That Image

The latest crop of color flatbed scanners combines high resolutions and intuitive designs with ample software bundles—all at affordable prices.

Canon Computer Systems (800-848-4123, www.ccsi.canon.com) has added two new entries to its CanoScan line: the **CanoScan 600** (\$400 street), aimed at business users, and the **CanoScan 300** (\$230 street), aimed at home users. The CanoScan 600 provides 600- by 1,200-dpi resolution and a 30-bit-internal/24-bit-external scanning mode. The home-oriented CanoScan 300 provides 300- by 600-dpi resolution at 24-bit color. Both models come bundled with Adobe PhotoDeluxe as well as Visioneer PaperPort LE with Xerox TextBridge OCR.

Targeting budget-conscious buyers is Microtek Lab (310-297-5000, www.microtekusa.com), whose latest 30-bit offerings include the **ScanMaker V310** (\$150 street) and the **ScanMaker V600** (\$250 street). The V310 has an op-

tical resolution of 300-by-600 dpi, while the V600 ups the resolution to 600-by-1,200. Each of these scanners connects to your PC via an EPP connection and comes with steel guiderails, improved mirrors, and new excess-light-reduction technology. Bundled with both ScanMakers are Kai's Power Soap, iPhoto Express, PaperMaster 2.0 SEC, and Caere OmniPage LE OCR software.

Microtek also has two new

higher-end scanners for such large-format materials as newspapers or tabloids. The **ScanMaker 6400XL** (\$1,000 street price) delivers 400- by 800-dpi resolution, while the **ScanMaker 9600XL** (\$1,500 street price) offers 600- by 1,200-dpi resolution. Both scanners are 36-bit color, SCSI-based units that come bundled with Adobe PhotoShop LE, MetaCreations Painter 5, and Caere OmniPage LE.

REGAP In our First Looks roundup of seven value flatbed scanners (November 4, 1997), we gave our Editors' Choice to the Visioneer PaperPort 6000.

From Plustek USA (800-685-8088, www.plustekusa.com) comes the \$99 **OpticPro 600P**, a 30-bit, 300- by 600-dpi device with an 8.5- by 11.7-inch scanbed. Its \$499 sibling, the 11.7- by 17-inch **OpticPro A3I**, is a large-format 30-bit unit that scans tabloid-size (and larger) images at 400-by-800 dpi. The OpticPro 600P ships with Micrografix PhotoMagic, and both models come with Expervision's Type Reader OCR package.

For high-end users, Mustek (800-468-7835, www.mustek.com) is offering the \$999 **Paragon Power Pro**. This SCSI-based flatbed device scans letter-size sheets at 1,200- by 4,800-dpi resolution in 36-bit color. It can function in Windows or Macintosh environments, and it ships with Xerox's TextBridge OCR software.—
Roderick A. Beltran

32X CD-ROM DRIVES

The Next Notch Up

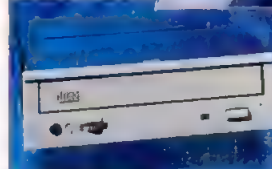
Amid the clamor for new CD-R and DVD products, it's easy to forget that traditional CD-ROM technology is continuing to advance. A number of vendors are offering new drives that can spin your CDs at faster rates than ever, providing further improvements to your CD data access times.

Panasonic Computer Periph-

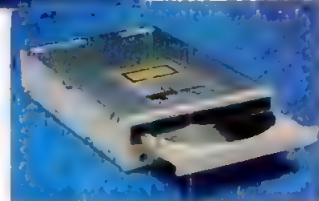
eral Co. (800-742-8086, www.panasonic.com/alive) is now sell-

ing the **Panasonic LK-MC682BP** (\$150 street), an IDE-based drive that spins at 32X. The drive achieves its speed by using Constant Angular Velocity technology (CAV), which varies the disk's spin rate depending on whether the data being sought is located on the inner or outer tracks. The unit has a rated transfer rate of 4,800 KBps and a rated access time of 65 ms.

Toshiba America Information Systems (714-457-0777, www.tais.com/taisdpd) is currently offering the **Toshiba XM-6200** series of 32X CD-ROM drives, which includes the internal ATAPI IDE-based **Toshiba XM-6202B** (\$130 street price), the internal SCSI-2-based **Toshiba XM-6201B** (\$150 street price), and the external SCSI-2-based **Toshiba XM-6201F1** (\$200 street price). All three members of the series offer a 75-



SPEEDIER SPINS: CD-ROM drives from Panasonic, Toshiba, and Mitsumi.



ms average seek time and an 85-ms average access time. Like the Panasonic units, the Toshiba drives use CAV technology.

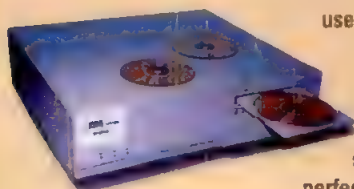
Also competing in the 32X market is Mitsumi Electronics Corp. (972-550-7300, www.mitsumi.com), whose \$199 ATAPI IDE-based **Mitsumi FX320S** uses CAV technology, includes a 256K built-in memory buffer, and has a 65-ms average access time. It also features anti-jitter technology.—
Josh Le

How to Clone A CD-ROM

As a precaution against damage or loss, it's always a good idea to make back-up copies of CD-ROM applications you've purchased or data disks you've burned yourself. The **CDXpress** CD copier, from Princeton Diskette Co. (800-426-0247, www.princetondiskette.com), makes this easier than ever. An external device based on a SCSI interface, the CDXpress copies entire CDs at a time using virtually any standard format.

There are two versions: a \$1,695 2X-write/4X-read model based on a Philips drive and a \$1,995 4X-write/6X-read model based on a Yamaha drive. In either case, it's simple to use. Just place the source disk

in your computer's CD-ROM tray, place a blank CD-R disk in the tray of the CDXpress, run the software, and presto!—a perfect CD clone.—*JL*



Going faster than the other guy
It's a prerequisite. Running the
hottest, most challenging of all



Having the
when you want and
It's an absolute. And having it
leg isn't a pipe dream. Today it's
Because you are a **rebel** with a

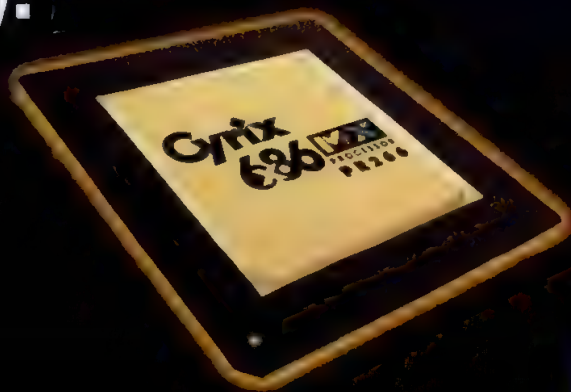
Shorter is faster.

Winstone 98 for Windows 95.



Configuration: Microstar MS5164 Motherboard; ALI 1531 Chipset; Quantum Fireball ST43A013 disk drive; Diamond Multimedia Viper V330 PCI Graphics Card w/4MB SDRAM (driver rel. VP0015P); 1024x658
*Num II was tested on an ASUS P2L97 motherboard and the Triton 440LX chipset. Cyrix is a registered trademark and 6x86MX is a trademark of Cyrix Corporation. Windows 95 is a registered trademark

isn't optional.
latest, greatest,
software programs isn't nice.
It's **mandatory.**
power to do what you want,
how you want isn't unrealistic.
all without paying an arm and a
a reality.
cause.



And your PC is
powered by the

Cyril
686 **MX**
PROCESSOR



resolution (16M colors at 75MHz); 32MB SDRAM RAM; 512K pipeline burst; 33MHz PCI bus speed. All systems tested using identical configuration with one exception:
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E-MAIL UTILITIES

Return to Sender

Every time you check your e-mail, your mailbox is filled with opportunities to make fast money or speak with comely young women. Junk e-mail, or spam, can be annoying at the least and waste your time, clog up your computer, and potentially expose you to harm. You can shield yourself against such unwanted messages with two new e-mail filter products that still let you get the messages you want.

America Online's (800-827-6364, www.aol.com) **Mail Controls**

tools enable AOL subscribers to avoid unwanted e-mail by letting them set one of four e-mail acceptance levels. By using keyword: Mail Controls, you can opt to receive mail from AOL members only, members plus specified domains or addresses, or all sources.

Using a knowledge base of

more than 400 rules, Omron Advanced Systems' **MailJail** (\$24.95 via download, \$29.95 on CD) checks whether a message comes from a "frequent sender" or known spammer and if so, blocks it

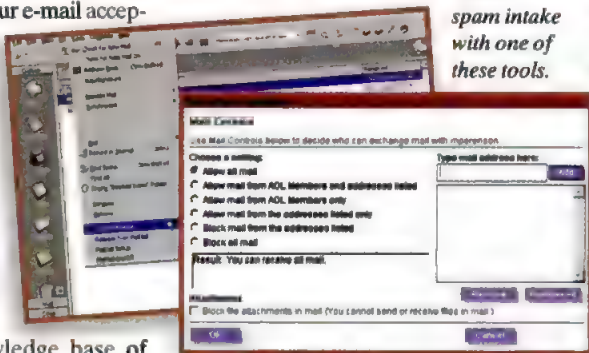
CANNED SPAM:

Control spam intake with one of these tools.

(408-727-6644, www.mailjail.com). New filtering rules are added to the package once a month using MailJail's online service.

You can also determine junk mail with MailJail's intelligent e-mail filter. Using the Send to MailJail and Release from MailJail features, the program first learns your e-mail preferences and then identifies and filters unwanted mail. MailJail checks the entire contents of each message to make sure no junk e-mail slips through.

—Doug Beizer



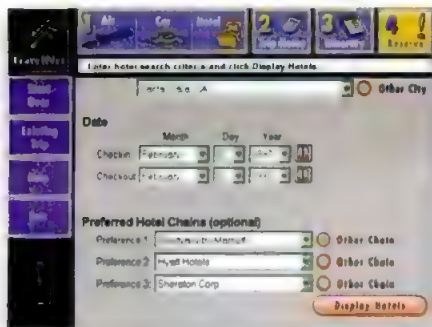
CORPORATE TRAVEL SITES

On the Road Again

With online business and leisure travel spending expected to grow from \$827 million annually today to \$8.9 billion by 2002, new travel-management solutions have

er" services are emphasized.

Since AXI (pricing is customized for each user) uses Microsoft's Expedia software, users get such features as airline seat



CHECKING IN: Reed Travel Group's TravelNet helps you find the perfect hotel.

emerged to tackle the issue of corporate control over expenses.

For businesses that use American Express as their travel agency, the company offers **American Express Interactive (AXI)** (212-640-4546, www.americanexpress.com/corporateservices), a Web-based travel solution that integrates a company's travel policies and then automatically steers travelers to proposed reservations. Reservations that do not comply with the policy are flagged, while "preferred suppli-

maps for seat selection and access to international destination information. The travel system can operate in multiple environments, with multiple computer reservations systems and an Internet, intranet, or extranet connection.

Sabre's **VantagePoint** (888-722-7328, www.travel.sabre.com) enables corporate travel managers to compare negotiated vendor agreements, booked travel services, and actual travel expenses, so you can make itinerary adjustments before dollars are spent.

VantagePoint collects and consolidates expense information from various travel data sources, including Sabre's own global distribution system. An extranet-enabled version of Sabre BTS is in the works, while the Windows, Lotus Notes, and intranet-compatible suite with VantagePoint is now available.

TravelNet, from the Reed Travel Group, links your corporate travel-management system directly with Pegasus System's Thisco UltraDirect hotel-room search engine (408-327-9900, www.travelnet.com). The Pegasus engine surveys negotiated rates from over 16,000 hotel properties and then lists available rooms by the best rate.

TravelNet then books the room, issues a confirmation number, and forwards the reservation information to the company's travel

agency for ticketing. Travelers can access their company's travel policy and change or cancel their reservations electronically.

TravelNet is available with either "whole site license" or "transaction-oriented installation." The whole site fee starts at \$100,000 for a small company with under \$3 million per year in air volume. Transaction-oriented installation starts at \$15,000, with \$5 for each trip-booking transaction.—Emily Cohen

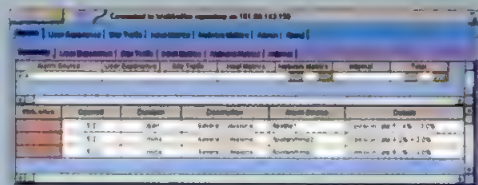
Sniffing Out Trouble

More and more Web sites are becoming the first points of contact between organizations and their clients, making site maintenance and analyzation crucial. Being able to know who your site's visitors are won't help you, though, if your server isn't working.

To combat this problem, Network Associates adds another member to its family of Sniffer tools with **WebSniffer** (800-764-3337, www.networkassociates.com). A site management tool aimed at Webmasters, WebSniffer works at the server end to locate, analyze, and suggest solutions to site failures.

The WebSniffer Agents compile statistics on network and server performance. The WebSniffer Information Center, which is part of the Repository, provides the user interface in a Java applet. Its alarm screen shows where the

problem is and can dispatch notification to e-mail addresses or pagers. The applet also includes an "Expert Explanation" of the problem, which fully describes the fault and recommends solutions with optional statistics and graphs.—Jennifer Anderson



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PC Today - January 98

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5020ECX	233MHz Pentium® Processor	4.0GB HDD	64/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$4895.00
5010ECX	233MHz Pentium® Processor	3.1GB HDD	64/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$4595.00
5000ECX	233MHz Pentium® Processor	3.1GB HDD	32/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$3995.00
3030ECX	233MHz Pentium® Processor	4.0GB HDD	64/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$4495.00
3020ECX	233MHz Pentium® Processor	3.1GB HDD	64/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$4295.00
3015ECX	233MHz Pentium® Processor	2.1GB HDD	32/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$3595.00
3010ECX	200MHz Pentium® Processor	3.1GB HDD	64/128 MB RAM	14.1" XGA TFT	56K Modem	20X CD-ROM	\$3995.00
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Trends Networking

INTERNET PHONES

Net Dialing

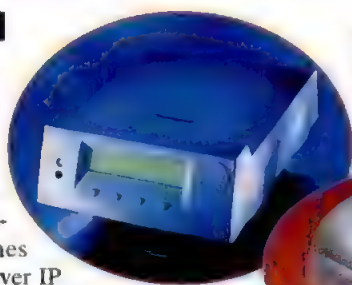
There's been a lot of talk of integrating the Internet into various ordinary appliances. First to surface are telephones that are going online. There are a wide variety of new telephone products that are tied in some way to the Net, including standalone voice-over IP (VOIP) devices (which remove the need for specialized software and high-end PCs) and fully integrated Internet appliances.

The \$299 **InfoTalk** device from InnoMedia (408-562-3535, www.innomedia.com) sits between a regular phone and the wall jack. The unit features a built-in modem and uses InnoMedia's proprietary compression technology to assure high sound quality. Once you establish a voice phone connection,

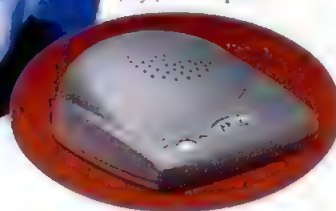
InfoTalk automatically re-establishes the call over IP lines using your Internet account.

Aplio (650-794-2760, www.aplio.com) offers a true standalone Netphone solution with its \$199 **Aplio/Phone**. In addition to working as a regular phone, the **Aplio/Phone** includes a built-in modem and has full-duplex sound. Each caller needs IP access and an **Aplio/Phone**; no PC or extra software is required. A starter kit with two phones is available for \$379.

The phone has two modes. One lets you place a call to someone over regular phone lines,



PHONE NET: Place long-distance calls using your ISP with devices from InnoMedia (left) and Aplio.



then hit the **Aplio** button and hang up. In under a minute, **Aplio/Phone** will reconnect the call over IP lines. The other, a unique **Economy** offering, removes the initial call by setting the phone to an "answering" mode that you can use for pre-arranged calls.

Cidco (800-929-8246, www.cidco.com) has a telephone that provides a complete Internet gateway. The \$499 **Cidco iPhone** is touted as the "world's first Web-

based phone." The phone connects to a POTS phone line and features an integrated 14.4-Kbps modem. **Cidco** has contracted with **Concentric Network** to provide automatically registered, unlimited Internet access at \$19.95 per month.

The **iPhone** includes a slide-away keyboard and a 7.4-inch monochrome VGA touch screen with stylus. It has its own operating system for one-stop access to the Web, e-mail, and information directories. The unit hyperlinks all phone numbers to provide one-click dialing, and it includes 2MB of DRAM—enough memory for more than 200 contacts. A flashing message light alerts you to both voice or e-mail. A full-size keyboard will be available shortly after you read this and a compact printer unit should be available late this spring. —Michael N. Rusignuolo

NETWORK ANTIVIRUS

Network Medicine

For true virus protection on a network, you must guard all your desktop systems as well as your network servers. The latest network-antivirus products available offer both centralized antivirus management and protection for servers.

eSafe Technologies (888-772-3372, www.esafe.com) offers a network-wide solution with **eSafe Protect Enterprise** (site licensing averages \$40 per seat). As with the single-user version, the program not only protects against viruses, but it also protects against what **eSafe** refers to as "vandals"—any malicious code and hostile Java apps or ActiveX controls that can affect your system. This protection stems from **eSafe's** Total Sandbox Quarantine Technology, which runs all programs in a safe area of your hard disk.

Internet Protection Modules (IPMs) reside at specific places on the network to provide pro-

tection (Client IPMs for individual workstations and Server IPMs for Windows NT or Network file servers). An optional Gateway IPM can detect and block vandals before they enter the system. The **eConsole** provides a central control panel for entire network protection. With it, you can set protection rules for the whole network, automatically deploy IPMs, manage cross-platform protection, and receive activity reports from individual stations.

Long a leader in the European AV market, **Panda Software** (415-392-5850, www.pandasoftware.com) enters the American market with a line that includes **24h-365d Antivirus Insurance** (site licensing starts at \$56 per seat). Actually a suite of **Panda** products, **Antivirus Insurance** for networked PCs provides desktop protection for workstations, while **Antivirus for Netware** and **NT Servers** of-

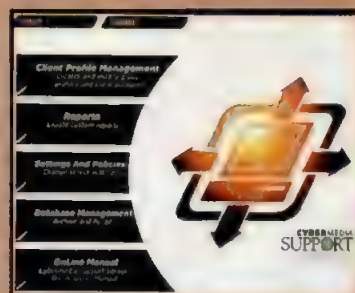
fers server protection. You can install and control both programs through the **Panda Administrator**. **Panda** offers free 24-hour Hot-Line user assistance and free virus updates mailed to you for a renewable

three-month period. Also included is **S.O.S. Virus**, which guarantees delivery of a new version of the program in 24 hours if you discover a new virus the program does not protect against.—MNR

Remote Repair

No network administrator has enough time to manage each and every problem he or she comes across. **CyberMedia** (310-581-4700, www.cybermedia.com) has recently developed a brand new way to automate technical support for mid- to large-size businesses with its new **CyberMedia Support Server Repair Engine for Workgroups 1.0**. First in a planned line of Support Server products, the **CSS Repair Engine** analyzes and solves minor problems on a client desktop without routine manual checks. The product offers the unique ability to scan and repair a drive completely undetected, with no user input necessary.

CyberMedia claims that the **CSS Repair Engine** may reduce Total Cost of Ownership (TCO) by as much as 30% by automatically alleviating problems such as missing drivers, broken shortcuts, system crashes, or altered registry files. **CSS Repair Engine** is offered in 5-seat, 10-seat, 25-seat, and 50-seat licenses, with an introductory cost of \$90 per seat for the 50-seat license.—Stephanie Lindenbaum



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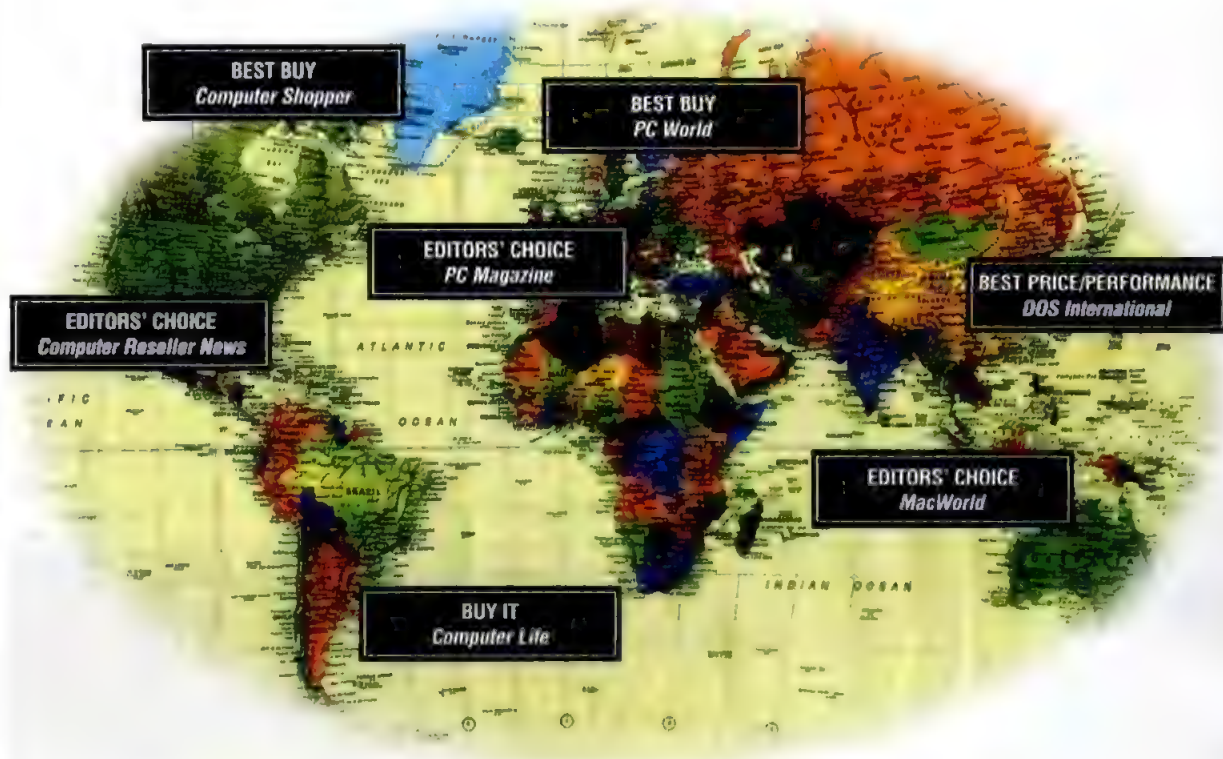
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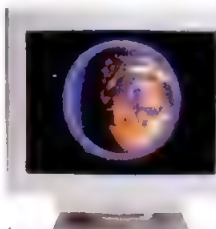
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First Looks



A Medium for Your Message

We test six software packages that deliver audio/video presentations over the Internet.

By Jan Ozer

No one can deny the power of a live presentation, but there's one big problem: You have to be there live, which is often difficult when you're delivering your message within a large company or to suppliers, customers, or prospects. A new breed of products, however, helps you leverage your efforts by producing a synchronized audio/video presentation that can be delivered unattended over intranets or the Internet.

We evaluated six such products: Astound Dynamite, In-Media Slides & Sounds Plus, Lotus Freelance Graphics 97, MatchWare Mediator 4.0 Pro, Microsoft NetShow, and Software Publishing Corp.'s ActivePresenter. Each costs under \$375, and most individually cost under \$200. Also, all of these products enable Web playback without making you install proprietary software on your HTTP server (though NetShow also offers an optional server).

In addition to price, several factors distinguish our product group from other multimedia formats. These packages are all WYSIWYG end-user tools specifically designed for presentations or slide shows, and all are well within the reach of even computer novices.

Though you can develop these presentations in Macromedia Director and output Shockwave files, Director costs \$995 (list) and is a complex program best left to design professionals. Similarly, Flash costs only \$299 (list); it's also a general-purpose developer's tool, primarily designed for vector graphics. Another alternative is Apple's QuickTime VR (\$395 street), which builds 3-D models (not the 2-D presentations we focused on in this roundup).

HOW WE TESTED

We tested two scenarios built in PowerPoint '97 that were imported directly into each application

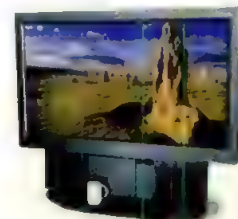
when possible or duplicated closely when not. The first is a five-slide bullet-based presentation with audio, suitable for explaining a new marketing program or a change in the benefits package. The second is a six-image slide show with audio, which you might use to display pictures of your new product or your last vacation. We evaluated each program's ability to deliver this presentation on a Web page and via e-mail.

DELIVERY OPTIONS

Our products fall into three distinct categories, all with different delivery paradigms. Some, like Dynamite, produce HTML that plays back using the familiar page-at-a-time delivery dynamic (you know the drill: You turn a page, then wait for the content to download and display).

Others, like Mediator, produce embeddable files that remote users download and play using proprietary plug-ins. With this approach, playback doesn't

INSIDE

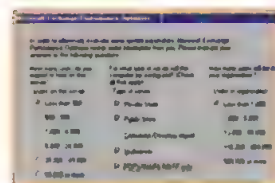


THE BIG PICTURE:

Spice up your conference room with Sony's 50-inch KL-W9000 LCD Rear Projection Display. For the review, see page 53.

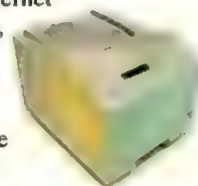
GROUP IT:

Microsoft Exchange Server 5.5 combines strong messaging facilities with collaboration. See page 62 for the review.



NEW PHASE:

The Tektronix Phaser 360 has a faster processor, a new ethernet adapter, and a new resolution. See page 66.



More Products Reviewed...

Visual dBase 7	56
GroupWise 5.2	62
HP ScanJet 5100c	68
In Focus LP420	68
Instant Internet 100	73
SPSS 8.0 for Windows	76

First Looks Online

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First Looks

start until the entire file is received by the remote users. The final and most responsive approach used solely by NetShow is called streaming. Here, the slide show starts to play when selected by the remote user and—bandwidth willing—continues to play without interruption until the file is complete.

The first question you should ask is whether the presentation can play on all your target platforms. Consider both operating-system support (most relevant when plug-ins are involved) and browser levels (important for DHTML products).

Next is responsiveness, or how long your viewers must wait to play your presentation. Smaller presentations download faster, generally improving responsiveness. Even though all tests started with the same content files, we saw remarkable swings in presentation size. Also consider audio and still-image quality, where we again saw large variations (especially in image quality).

Finally, look at performance and stability. Though HTML and Java-based solutions offer broad compatibility, they typically don't produce tightly synchronized presentations, especially over modem connections. In contrast, proprietary end-to-end solutions may limit your audience but provide excellent performance.

On the whole, we found some surprising feature gaps. For example, not all of the products supported both JPEG and GIF images, a shocking oversight for products designed for low-bandwidth presentations. And speaking of being shocked, no products supported Shockwave, Flash, VRML, or even RealVideo or Vivo. Only two products supported RealAudio, and neither did so particularly well.

Despite their individual shortcomings, these products provide an engaging medium for delivering your information. And at a higher level, they present you with a better way of using your Web site to leverage your compa-

ny's intellectual assets, which, after all, is what this Web stuff is all about.

Astound Inc.

Dynamite



Our Editors' Choice in this roundup, Astound Dynamite (\$125 street) is a WYSIWYG Dynamic HTML (DHTML) editor with some great features for creating Web-based presentations (though it's unsuited for e-mail-based presentations). Count on a short but steep learning curve and a long test cycle, however, to minimize minor problems encountered in both appearance and playback timing.

Like most HTML editors, Dynamite starts with a blank

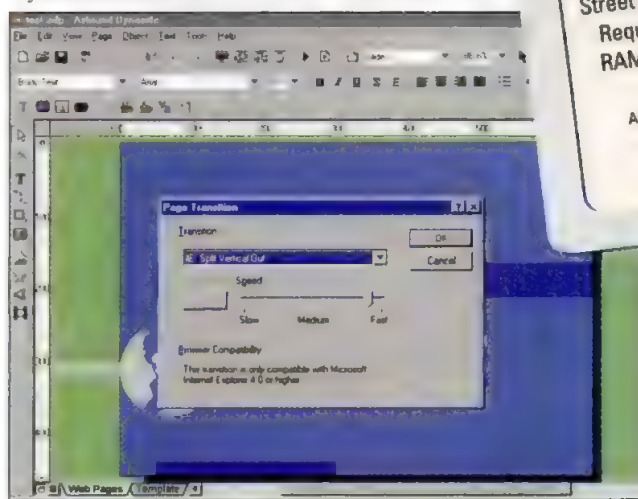
interactive buttons with simple controls for linking to internal and external pages.

Dynamite supports several bitmapped formats, including GIF and JPEG, with basic image-editing capabilities. You can input .AVI, QuickTime, and MPEG videos and Autodesk Animator and Astound animations. Though the program reportedly supports RealMedia audio and video files, we could not successfully load either on our two test systems; still, Astound's technicians could load our Real Audio files into our presentation on their machines. Nonetheless, Dynamite handled compressed .WAV formats like TrueSpeech, largely accomplishing the same purpose.

The strength of DHTML is in

HTML and Java Script files and automatically tracked content files. You can create Dynamic and/or static pages that lack transitions and animations. If you choose DHTML only, Version 3.0 browsers display a message that the pages contain unsupported DHTML output. You can also opt to transfer remote users to another URL. If you elect both Dynamic and static files, Version 3.0 browsers automatically load the static HTML files.

Dynamite's presentations are very compact. Our slide presentation totaled only 259K, including about 114K of Java executables, which are uploaded only once to most browsers. Our six-image



HELPFUL HINTS: Astound Dynamite tells you which browser level is required to play back each effect.

canvas surrounded by tool bars. The program's 14 templates are Web- rather than presentation-oriented, but you can easily import presentations from PowerPoint. You can also save and reuse templates for future projects.

All text entry is free form, so you'll have to space bullets and sub-bullets manually, a tedious process simplified somewhat by snap-to-grid capabilities. Drawing templates help you create in-

special effects, and Dynamite doesn't disappoint. There are 28 slide transitions, most with customization options like speed or direction, and you can animate text and images and insert animated GIF files or Astound animations. As you select effects, Dynamite details the browser level required to play it, enabling informed design decisions.

Dynamite's publishing capabilities are another strength. The program created all required

slide show totaled 301K, one of the smallest here. Still, Dynamite can't output a single distributable file, making it a bad choice for e-mail or downloaded presentations.

Despite their compact size, DHTML files loaded and played slowly; this was probably due to the Java engine, since static HTML files were more responsive. Such latency often marred playback timing, with audio truncated as the next slide appeared prematurely. In addition, the static HTML created from the PowerPoint presentation showed several formatting errors. Count on testing your project extensively to limit these problems.

Dynamite doesn't require a proprietary plug-in and benefits from DHTML's broad operating-system compatibility. Clearly the wave of the future, Dynamite does a great job of making DHTML usable today.

Astound Dynamite
Street price: \$125 (before \$25 rebate).
Requires: 486 CPU or better, 16MB RAM, 20MB disk space, Microsoft Windows 95 or NT 4.0
Astound Inc., Sunnyvale, CA, 888-427-8686, 408-720-0337
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Editors' Choice

• Astound Dynamite



Given the diversity of our products, choosing the best "one-size-fits-all" program was a difficult task. Closest to that description is Astound Dynamite, which provides both

universal compatibility and an advanced feature set with its Dynamic and Static output.

We especially like Dynamite's helpful messages describing which browsers are required to play back selected transitions (warning you, for example, that only IE 4.0 could play back a selected effect). Like many Java-driven multimedia players, Dynamite exhibited some latency during playback, but the product's feature set and compatibility warranted the Editors' Choice of this roundup.

Two other products are worth mentioning for application-specific tasks. Microsoft's free NetShow does a stunning job interleaving

real-world JPEG images with audio for a high-quality streaming presentation at breathtaking bandwidths. Though less bandwidth-efficient, NetShow Presenter and PowerPoint '97 enable real-time slide-show broadcasting over corporate intranets.

Consider MatchWare's Mediator when your presentation has to be precisely synchronized or highly interactive. Even though it's a download and play solution, the product is extraordinarily efficient, with control files adding negligible bulk to total download size. Mediator's most significant drawback is that playback is limited to computers running Microsoft Windows 3.1, 95, and NT.

InMedia Presentations Inc.

Slides & Sounds Plus

As the name suggests, InMedia Presentations' Slides & Sounds Plus (\$69 list) works primarily with pictures and sounds, performing acceptably for e-mail or downloaded presentations but erratically for Web-based output. Those developing text- and bullet-based presentations should look elsewhere, because the program's text capabilities are extremely limited.

Slides & Sounds is a slide sorter that arranges images into a slide show with audio, transition effects, and text captions. The program outputs a self-executing Mac or Windows file that can be e-mailed or downloaded as well as Java-enabled HTML output.

You begin by setting the presentation resolution and then inputting images from Twain-compatible sources like digital cameras or files from disk, including GIF and JPEG formats. Once loaded, you can crop your images, adjust color and brightness, and perform

other minor edits. Next you set slide duration and choose from over 100 slide transitions. You can add .WAV, MIDI, and CD audio to any slide, but you can spread only a MIDI file over several slides. Captioning is limited, but you can animate text by adding letters to sequential frames and playing them back without delay. This is inelegant, but effective.

When ready to publish, you

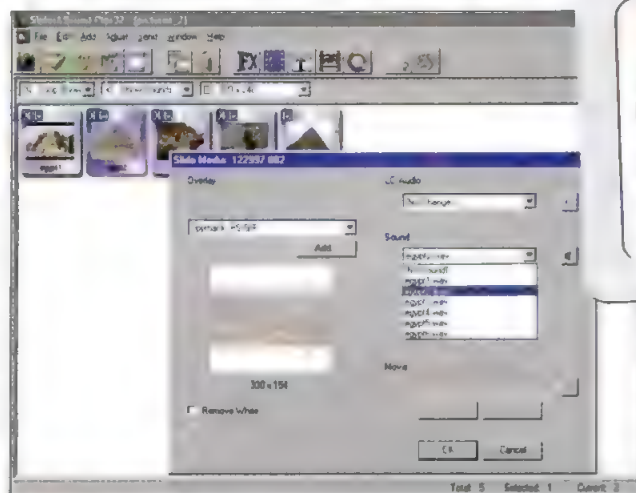
select either e-mail or HTML output. Slides & Sounds uses a completely random set of transitions for Web presentations, reportedly because the developers couldn't match the feature set of the Java-based player with the desktop player. Slides & Sounds generates the required HTML and Java libraries and compresses images into JPEG format and audio into AV

format. AV files average 7K/second, too large to stream over most modem connections. In addition, Slides & Sounds repeatedly failed to compress the initial audio file in our presentation, a problem that InMedia's technical support couldn't resolve.

At the highest JPEG compression setting, total downloadable files exceeded 850K, including about 200K of Java executables (larger than most Web-based solutions). InMedia's Java-based player performed erratically, failing to play audio in auto-playback mode and playing only intermittently in manual mode.

If you elect to e-mail your presentation, the program fails to compress either the images or the audio files. The Slides & Sounds player crashed when we input several different flavors of compressed audio. So for our tests, we used 8-bit, 11-KHz mono. With these inputs, our six-slide presentation totaled 1.584MB, including the player. Once downloaded and initiated, the player worked well in automatic mode, but it didn't play audio files when driven manually.

Slides & Sounds works well for image-based presentations



SOUNDS SIMPLE: Slides & Sounds Plus makes it easy to add audio or video to any slide or to a graphic overlay.

InMedia Slides & Sound Plus
List price: \$69. Requires: Pentium/60 or higher CPU, 16MB RAM, 20MB hard disk space, Microsoft Windows 95 or Windows NT

InMedia Presentations Inc., Vancouver, B.C., Canada;
888-575-4337, 604-893-6855

www.inmediapresentations.com

Choose 411 at www.pcmag.com/infoink.

displayed from high-bandwidth mediums such as hard disks and CD-ROM drives. As an Internet solution, however, it's inferior to several other candidates and lacks the text-based functionality to even be considered for bullet-based presentations.

First Looks

Lotus Development Corp.

Freelance Graphics 97

Lotus Freelance Graphics 97 (\$355 street) offers two useful but limited Web publishing options. Output to HTML creates a universally compatible presentation, but it produces austere Web pages and can distort the colors of 24-bit images. Or you can opt to play Freelance's native files with full formatting and interactivity using a browser plug-in or standalone player (this solution is strictly for Windows 95 or Windows NT computers). Consider both options if you already have Freelance, but neither is a compelling enough reason to buy the program.

Freelance provides 30 customizable, business-oriented templates, some with wizards by such content experts as Zig Ziglar and Gemini Consulting. After selecting a template, you can edit page format, edit background styles and colors, and input a background bitmap.

You create your presentation in the WYSIWYG page view, supplemented by page sorter and outline views. Multimedia support is limited, especially for Web output. Freelance can import many file types, including .BMP, .PCX, and .TIFF files. There's support for .WAV and .MIDI files, but not RealAudio.

You can choose among 27 page and object transitions and elect to have a sound trig-

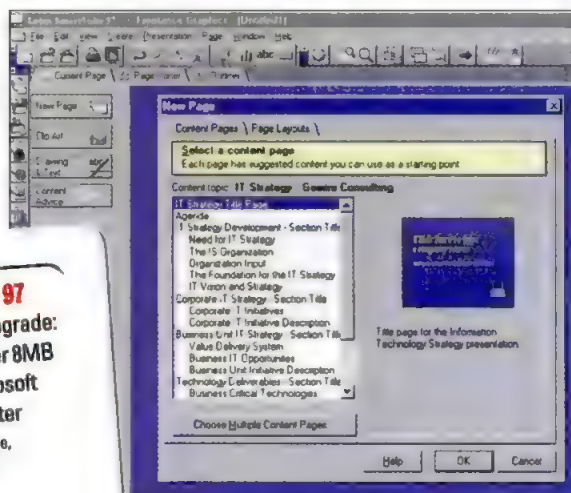
REUSABLE:

Freelance's 30 customizable, business-oriented templates give you the ability to create detailed and content-rich presentations.

Lotus Freelance Graphics 97
Street price: \$355 (Competitive upgrade: \$105). Requires: 386 CPU or better 8MB RAM, 18MB disk space, Microsoft Windows 95 or NT 3.51 or later
Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500
www.lotus.com
Choose 412 at www.pcmag.com/infoclink.

gered upon page entry. All text, drawings, and images can be made interactive (they can be made to jump to another page or remote URL, play a sound, or run an external application when clicked). You can also sequence the appearance of these objects on a page. But since Freelance supports only HTML level 2.0, most animated effects are lost when outputting to HTML.

Though Freelance's HTML output size was reasonable (281K for the slide show and 155K for the bullet presentation), the output was flawed. Freelance creates a GIF file for



each screen, to be displayed in a small window of an HTML page with simple navigational controls. Page characteristics like background bitmaps are integrated into the GIF file and don't carry over to the final Web presentation, which has a plain white background. Although this works reasonably well for bullet-point presentations with limited colors, converting to GIF format distorted the color of our bitmapped images.

On the other hand, publishing in Freelance's native PRZ format works well with bullet-based presentations intended for both e-mail and Web distribution—so long as your target audience uses Windows 95 or Windows NT, the only platforms supported by the respective players. In this format, our bullet presentation totaled only 169K, though

the image-intensive slide show ballooned to a bandwidth-busting 2.6MB.

As a presentation program, Freelance offers some great features, including a host of useful templates and group-editing capabilities. Its remote distribution options can be useful, but you should be sure to

consider their limitations.

MatchWare Ltd.

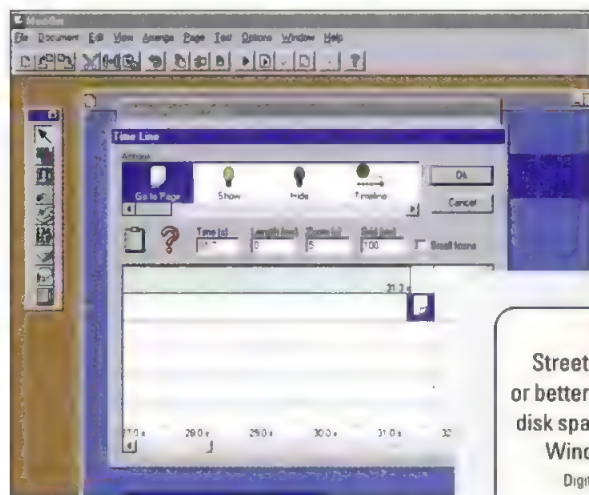
Mediator 4.0 Pro

MatchWare's Mediator 4.0 Pro is not the easiest program to use, nor at a street price of \$300 is it the cheapest. Nevertheless, Mediator excelled at creating synchronized presentations that play back efficiently over low-bandwidth connections (though it can't be used practically to create files for e-mail distribution).

Mediator creates MD8 files playable from within Navigator and Internet Explorer browsers via freely distributable plug-ins, but only with Windows 3.1, 95, and NT. These compact MD8 control files barely increase download size, and they add powerful timing, animation, and interactivity features.

Mediator is less user-friendly, which is indicated by the lack of design templates or the ability to import PowerPoint slides. We created templates in another program and easily imported them as GIF files.

The program doesn't understand bullets and sub-bullets, so you'll also have to design your own symbols and spacing (aided by snap-to-grid ca-



IN GOOD TIME: Mediator's time-line simplifies the synchronization of page effects.

Mediator 4.0 Pro
Street price: \$300. Requires: 386 or better CPU, 16MB RAM, 10-14MB disk space, Microsoft Windows 3.1, Windows 95, or Windows NT
Digital River/MatchWare, Ada, MN;
800-456-5443
www.mwin.com
Choose 413 at www.pcmag.com/infoclink.

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there is.



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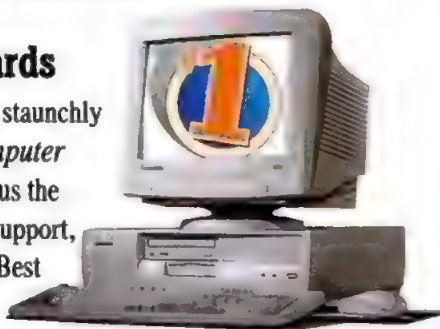
service. This state-of-the-art service gives you 30 hours of fast connections on our 100% digital network for only \$12.95 a month.* Add in one of our power-packed G-Series multimedia PCs with a Pentium II processor, and you've got the ultimate Web surfing combination.

*Restrictions exist in certain areas. Local access areas identified in registration process.



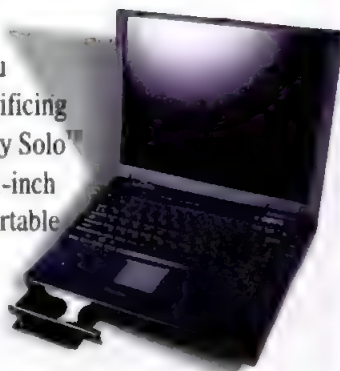
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Gateway Solo 2300SE, PC World Best Buy Award, January 1998

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- External Battery Charger
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Gateway Solo 9100, PC Magazine Editors' Choice Award, January 1998



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Gateway GP6-233, PC World Power Desktop, October 1997

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U.S. Robotics

* Capable of receiving at up to 56 Kbps and sending at up to 31.2 Kbps. Due to FCC regulations, receiving speeds are limited to 33 Kbps. Actual speeds may vary. Requires compatible phone line and server equipment. Complies with both the proposed ITU 56K standard and x2 technology protocols. Standard officially determined in February 1998. Ratification expected in September 1998. See www.3com.com/56k

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The first 56K standard modem is news.

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3Com, maker of the world's #1 selling modems, brings you the first modem to meet the new ITU 56K standard. Surprised? Probably not. After all, we introduced the first 56K* modem.

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New desktop modems and access servers will be available this month, with PC cards coming soon. You'll find a list of dealers where you can buy them on the 3Com Web site. And if you're currently an x2 user with a U.S. Robotics® modem, Megahertz® PC Card or Total Control™ access server, there's information on how you can easily upgrade.

Either way, www.3com.com/56k has everything you need to take advantage of the new standard. Which, coming from the company that connects more people to the Internet than any other, should be no surprise at all.



The U.S. Robotics ITU 56K
standard modem.
The world's first ITU 56K
standard modem.

First Looks

pabilities). It does offer basic drawing capabilities and a button editor, and it can input most still-image formats (including GIF and JPEG). The only supported audio formats are MIDI and .WAV, and the program can input .FLC and .FLI animation formats and .AVI and MPEG video formats.

With Mediator, you can animate virtually all page objects, hide and reveal them at will, or make them interactive to command functions such as if/then operations; file open, delete, or print; or entries into a SQL database. A page timeline lets you sequence activities to reveal text in time with audio or turn pages once the audio finishes.

When you're ready to publish, Mediator checks the code for errors, creates the MD8 control file, and copies all content into a distribution subdirectory. A wizard helps you create the HTML code, though you'll need a third-party FTP program to upload the files to your site.

Mediator doesn't compress still image or audio files, but it adeptly handled our JPEG and compressed audio files. The control files totaled only 8K, among the lowest in the review. Of course, remote users must first download the Netscape plug-in or IE ActiveX control before playing back the presentation.

Playback in both browsers from a remote Web site was essentially identical to disk-based playback, making Mediator one of the most responsive systems in our review. But Mediator doesn't bundle all content and player files into one executable, so it can't be easily used for downloaded or e-mailed presentations.

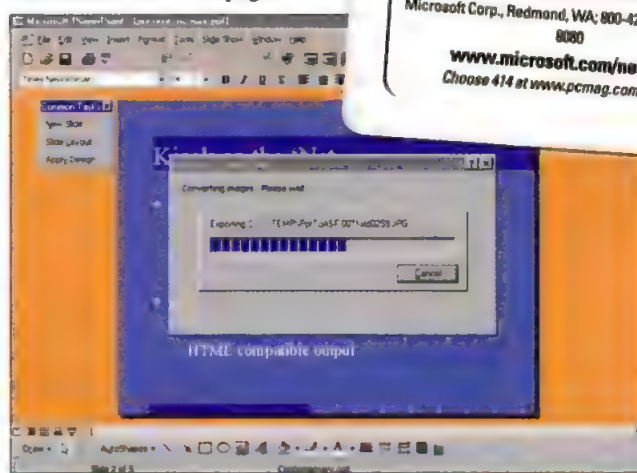
If you don't mind rolling up your sleeves to get the job done and you can live without Mac and Unix support, Mediator is worth checking out. But if these platforms are a must, or if you value ease of use over performance, look elsewhere.

Microsoft Corp.

NetShow 2.1

One little-known feature of Microsoft's free NetShow is its ability to interleave audio and JPEG files into a compact format that can be streamed over connections as low as 14.4 Kbps. Though you'll have to forego special effects and interactivity, this capability is useful for image-based slide shows, though somewhat less efficient with text and bullet-based presentations.

NetShow utilizes Advanced Streaming Format (ASF) files embeddable in Web pages or



MAKE A POINT: NetShow Presenter automatically converts PowerPoint slides to JPEG files and synchronizes them with audio.

transferable via e-mail. To display the files, remote users must install Microsoft's free NetShow Player, now available for the PowerMac, Unix, and Windows 3.1, 95, and NT platforms. Microsoft supplies two mechanisms to create ASF files: the ASF Editor and NetShow Presenter. You'll need to install the free NetShow server on your Web server to use NetShow Encoder for live presentations, but you can serve on-demand files with or without the server.

The Editor is a crude but functional timeline-based system that graphically represents audio and video files to simplify synchronization. First you set the target presentation bandwidth, which must be 14.4, 28.8, or 112.5 Kbps.

You can load .BMP files, which the program automatically compresses to JPEG format, or load JPEG files directly.

The only supported audio format is .WAV, with a number of compression options available before loading on to the timeline. Unfortunately, the ASF Editor doesn't support RealAudio.

Microsoft NetShow 2.1
Price: free. Requires: Pentium/133 or higher CPU, 16MB RAM, 21MB disk space, Microsoft Windows 3.1, 95, NT 3.51, or NT 4.0 (Server)
Microsoft Corp., Redmond, WA; 800-425-9400, 425-882-8080
www.microsoft.com/netshow
Choose 414 at www.pcmag.com/infotlink

The other ASF encoding mechanism, NetShow Encoder, encodes PowerPoint '97 presentations into ASF Format for live and on-demand presentations. We used its on-demand capabilities, which are limited to the same formats and bandwidths as the ASF editor, to create our bullet-based presentation.

Presenter works by encoding

all slides into JPEG format, which caused slight blockiness and distortion in our low bit-rate presentations (they disappeared at 115 Kbps). By contrast, the more JPEG-friendly real-world images used in our slide show were

crisp and artifact free.

NetShow is most valuable when working with real-world images for both e-mailing and Web-based delivery. In a pinch, you can also stream low bandwidth text and bullet files, but you should expect degraded quality at 28.8 Kbps.

Software Publishing Corp.

ActivePresenter

SPC's ActivePresenter (\$50 street) shines for developing desktop presentations. Its structured design approach is valuable to presenters of all skill levels (if overbearing at times).

SPC's offering consists of two programs, the main ActivePresenter program for creating desktop presentations and the WebShow Publisher for Internet distribution. In ActivePresenter, you build your presentations in a large, square work area with tabs for slide layout, background design, and color scheme. Layout options are particularly useful, with templates for tables, organization charts, and other slides.

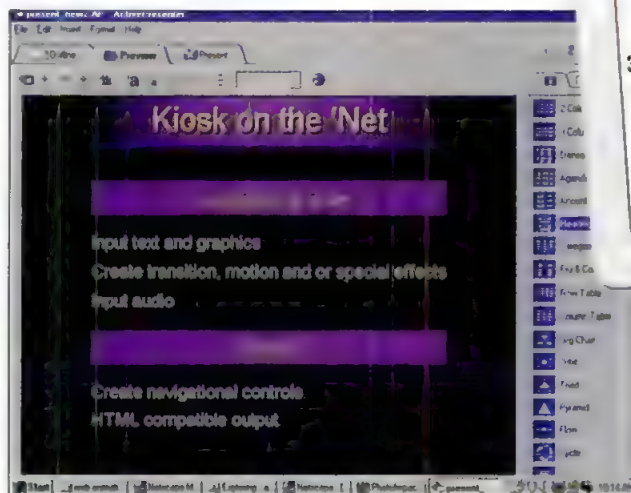
When creating a presentation, you enter titles and bullet points in outline mode and

First Looks

switch to preview mode to make aesthetic decisions and add images. The program accepts a number of bitmapped formats, such as GIF, but not JPEG—curious, given its Web orientation. As you enter data, ActivePresenter dynamically adjusts text and image size to help ensure a balanced appearance.

ActivePresenter's structure can be draconian, preventing you from making simple changes like italicizing or changing text color. Also, page transitions are chosen for you for desktop presentations, which will frustrate many users. ActivePresenter provides no direct multimedia support. All content is input as objects, which limits its functionality. There's also no animation capabilities or other special effects.

Once you've completed your work in ActivePresenter, you can prepare your presentation for the Web by opening WebShow Publisher, which offers two modes for uploading presentations to your Web site. In Quick mode, your



ANY LEVEL: ActivePresenter makes it easy to create compelling presentations, but its structure can become overbearing.

only option is to choose the appearance of the HTML page into which your presentation is embedded. In Advanced mode, you also get to select slide transitions and synchronize RealAudio files with your slides. Remote users can view your presentation via the WebShow plug-in, available

for Windows 3.1, 95, and NT and for Netscape 2.0 and higher and IE 3.0 and higher.

We experienced many annoying quirks with WebShow Publisher, such as the inability to install or use the program off-line or publish to disk. We couldn't create links with RealAudio files,

ActivePresenter
Street price: \$50. Requires:
386 CPU or better, 8MB RAM (12MB for NT), 15MB disk space, Microsoft Windows 95 or NT 4.0
Software Publishing Corp., San Jose, CA;
408-537-3000, fax: 408-537-3509
www.spco.com
Choose 415 at www.pcmag.com/infolink

and we couldn't connect to our FTP server, forcing us to perform all tests on SPC's server. Also, we couldn't measure the generated file's download size, since we couldn't publish to disk. In terms of quality, our bullet-based presentation looked great, but ActivePresenter dithered our images mercilessly, inserting obvious patterns and color shifts.

If you're developing bullet-based presentations and don't mind rolling up your sleeves, download the free evaluation copy. But until the program works better with images, those publishing picture-based slide shows should look elsewhere. **PC**

DISPLAYS

LCD Looms Large

Sony Electronics' 50-inch KL-W9000 LCD Rear Projection Display delivers the big picture.

By Alfred Poor

Color plasma may be grabbing headlines, but LCD technology has not conceded the large display market yet. The Sony KL-W9000 LCD Rear Projection Display (\$7500 street) demonstrates this point with its 50-inch diagonal screen (49.1-inch viewable).

The 16:9 aspect-ratio image is created using a three-panel polysilicon active-matrix LCD similar to many LCD projectors, with the image beam folded by mirrors and directed at a rear-projection screen. As a result, the compact display case is only 106 pounds and less than 23 inches deep.

The display has a native resolution of 1,068-by-480, which is

the 16:9 equivalent of a VGA display. The Sony KL-W9000 has Digital Multi-Image Driver technology that does an excellent job of scaling higher-resolution images (such as SVGA and XGA) so that they remain legible with a minimum number of artifacts. It can also zoom or scale a 4:3 image to fill the full 16:9 region.

Front-panel controls and the full-featured remote control let you adjust brightness, contrast, and image size and position. They also control the tone and volume of the built-in two-speaker-plus-subwoofer sound system.

The display uses a combination of fresnel and lenticular lenses to channel and disperse the image evenly across the screen.



On our tests, we found that the image brightness was uniform, provided you were positioned horizontally from the center of the screen. The unit is rated for a 30-degree viewing angle above or below this point, but we found that the brightness was uneven if you were too high or low. But the 150 degree viewing angle to either side of center provided consistent brightness and legible images.

The display has connectors for three video sources and two

RGB inputs. Most of the connections are in the back, but one of each is in the front, making an ad hoc connection easy. The High Intensity Discharge 100-watt lamp is rated for a minimum of 8,000 hours of use, and it maintains full brightness across its life span.

For conference rooms and entertainment applications, the Sony KL-W9000 is priced well below plasma displays of similar size, yet it takes up about the same amount of space. It does cost more than an equivalent LCD projector, but it is more convenient to use and is easier to set up. As long as it is mounted at the right height, it's an attractively priced way to put the big picture in front of a group of people.

Sony KL-W9000 LCD Rear Projection Display. Street price: \$7,500. Sony Electronics Inc., San Jose, CA; 800-352-7669; www.sony.com/newdisplays. Choose 402 at www.pcmag.com/infolink.



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that let you increase the power, scalability and control of your server. The Netfinity 3500's \$2,365 ERP¹ price tag comes with top-of-the-line service and support. IBM is there to help you stay up and running every step of the way. We offer 90-day Start Up Support, innovative financing options, as well as technology exchange options. So you can concentrate on business, not your server. For more information on the Netfinity 3500 server, call us at 1 800 IBM-7255, ext. 4602, or stop by www.ibm.com/pc/us/netfinity



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First Looks

DATABASE DEVELOPMENT TOOLS

Bring Your Legacy with You

Visual dBASE 7 brings SQL access and true object-oriented programming to legacy database developers.

By Richard V. Dragan

Boasting excellent RAD ease of use and small-enterprise scalability, Borland International's Visual dBASE 7 Client/Server Suite (\$1,300 street price) provides a winning mix of new features, making it a worthy adversary in the lower-end database tool market. Though still primarily a traditional client-server solution, the new Visual dBASE offers much in the way of power and ease of development.

Visual dBASE's basic environment resembles other Borland tools that stress RAD-style component programming. The program's Project Navigator gives you easy access to all your projects, forms, tables, reports, and other database objects. Objects are grouped together by type for easy access and reuse, and they are accessed through a tabbed dialog box.

CONNECTING DATA

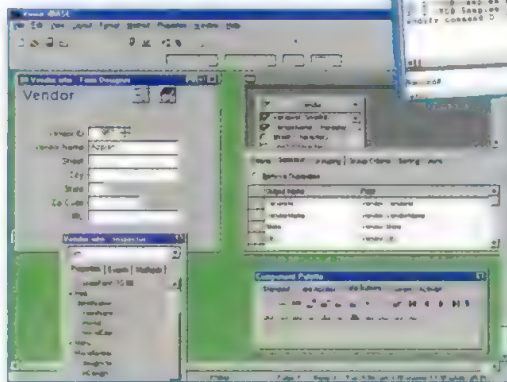
The database support in Visual dBASE is not just for legacy Xbase databases. You can still connect to dBASE and FoxPro files using the old .DBF format, but you can also connect just as easily to Access, Paradox, and a host of industrial-strength SQL databases through native drivers using Borland's Database Engine technology. There's also support for connecting to any ODBC database, too. For those who are committed to the .DBF format, Visual dBASE now supports new field types, such as auto-increment, date/time, long and double values, as well as referential integrity between tables.

The Client/Server Edition also features a migration wizard,

which lets developers move a legacy database to a more powerful SQL back end. The Visual SQL Builder wizard takes the bite out of working with SQL, even for beginners. This tool lets you design queries visually, and experts can tweak SQL code themselves.

YOUR DATA AT WORK

Once you decide on a database to work with, Visual dBASE's RAD programming style lets you design forms using dozens of components, including Windows common controls



EASE OF USE: Visual dBASE uses wizards and assistants for all common tasks, such as designing SQL queries.

(such as ListView and TreeView controls), a programmable grid, and data-bound controls (such as input boxes, images, and data-aware labels). The program ships with ActiveX controls for such advanced features as graphs, charts, and spreadsheets. You can also import third-party ActiveX controls and use them alongside the built-in components.

Visual dBASE's basic programming model will be familiar to anyone who has ever used such tools as Visual Basic or Delphi. Designing forms is a matter of dragging controls

from the component palette, customizing their appearance, and then adding event handlers or snippets of code that bring a database application to life.

Though you will still need to learn some of the Visual dBASE programming language, we created a simple inventory database front end with just a small bit of coding. You can toggle between the visual design mode and source code, which now uses a powerful, Brief-style editor with syntax highlighting. There is

breakpoints, view data, and step through code easily. To help deploy your Visual dBASE application, the Visual dBASE run-time engine lets developers deploy dBASE applications using a royalty-free compiler. You can also use the included InstallShield Express to deliver automated setup programs for your users.

One of the dark secrets of corporate database programming is lackluster report generators. We found the integrated report generator in Visual dBASE to be one of its best features, allowing flexible report generation from data. Reports can also be displayed in forms, which facilitates reuse between reports and forms.

This Client/Server Edition includes several other features for the small enterprise. Borland's standalone SQL database (InterBase) is included, as is Borland's MIDAS Busi-

OLD/NEW: Visual dBASE now supports object-oriented programming, but traditional script commands are still supported in the command window feature.

ness ObjectBroker for managing transactions in distributed systems. DeltaPoint WebTools supports publishing databases in Web pages through CGI.

Visual dBASE is geared toward the independent developer or small IS department interested in migrating a legacy database into a more robust corporate infrastructure based on a SQL server. The product's enterprise features make a smooth migration from old-style dBASE databases to industrial-strength SQL back ends a reality.

The enhanced Visual dBASE scripting language is now entirely object-oriented, with objects used to access all components, queries, reports, and other database objects. It's clear that this is now a much more powerful language, but users familiar with the procedural script of older dBASE will need to learn some new methods. For those with experience in Visual Basic, Delphi, or C++, this language will be easy to master.

BUILD, DEBUG, AND DEPLOY

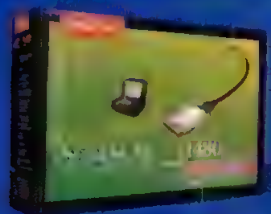
The dBASE compiler features fast 32-bit compilation and a debugger that lets you set

breakpoints, view data, and step through code easily. To help deploy your Visual dBASE application, the Visual dBASE run-time engine lets developers deploy dBASE applications using a royalty-free compiler. You can also use the included InstallShield Express to deliver automated setup programs for your users.

Visual dBASE is geared toward the independent developer or small IS department interested in migrating a legacy database into a more robust corporate infrastructure based on a SQL server. The product's enterprise features make a smooth migration from old-style dBASE databases to industrial-strength SQL back ends a reality.

Visual dBASE 7 Client/Server Suite. Street price: \$1,500. Requires: 486 CPU or higher, Windows 95 or NT 4.0, 16MB RAM, 30MB hard disk space, CD-ROM drive, and SVGA. Borland International Inc., Scotts Valley, CA; 800-233-2444, fax: 408-431-1000. www.borland.com. Choose 401 at www.pcmag.com/infolink.

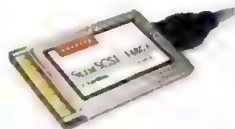
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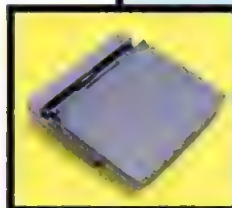
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First Looks

GROUPWARE

E-Mail Is the Key

Microsoft Exchange Server 5.5 provides the backbone for your groupware and collaborative applications.

By Steve Rigney

The hottest new intranet and network applications include those for group scheduling, threaded discussions, online meetings, and real-time chat. But these groupware or collaborative applications have one requirement: They need to travel over dependable messaging systems.

The latest release of Microsoft Exchange Server—Version 5.5—is first and foremost a strong messaging/e-mail system, with some collaboration utilities thrown in. Some of

a 16GB message store.

With the Enterprise Edition, you have no restrictions on the size of your message store other than the capacity of your hard disk. It includes all of the same features as the standard package, plus connectors that let you send and receive messages to PROFS and SNADS e-mail systems.

INSTALLATION

Although installation is straightforward and a lot easier than with some competing products (such as Lotus Domino), we did encounter a frustrating problem. If you want to use a Web browser to check your e-mail, join discussions, and perform other groupware tasks, you'll need to install IIS and a piece of software called Active Server Pages (ASP).

ASP works much like an enhanced version of the Common Gateway Interface (CGI) standard, and it translates the information in your Exchange database to HTML format. Unfortunately, ASP doesn't come with Windows NT 4.0, and the only place we could find it was in the Windows NT Option Pack. To make matters worse, the full Option Pack is approximately 27MB, making for a long download from Microsoft's Web site. Once you've installed ASP, however, the rest of the installation is a snap.

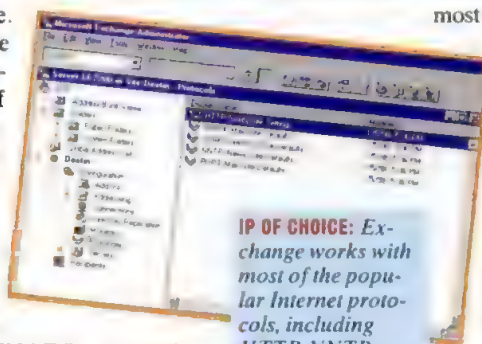
After the files are copied, the installation program prompts you to run the Performance Optimizer utility, which lets you set

up your server to provide the best speed for your configuration. All you have to do is answer basic questions, such as the number of users you expect to have and the type of message store you will use. You are able to run this utili-

messaging functions to Windows-based users (via the MAPI protocol). Exchange includes all of the standard Internet e-mail protocols: SMTP, POP3, IMAP4, and LDAP 3. This means that you can send and receive e-mail to almost any Internet/intranet mailbox currently on the market.

If you need to connect to several proprietary e-mail post offices, Exchange can help with that, too. It comes with several connectors you can use to attach your Exchange server to third-party message servers, including Lotus cc:Mail, Lotus Notes, Microsoft Mail, and even a mainframe PROFS mailbox.

One of these connectors' not-so-apparent benefits is their ability to act as e-mail gateways or switches. For example, if you have several Macintosh systems on your network, they have no easy way to access e-mail on a PROFS system; because Exchange lets you send and re-

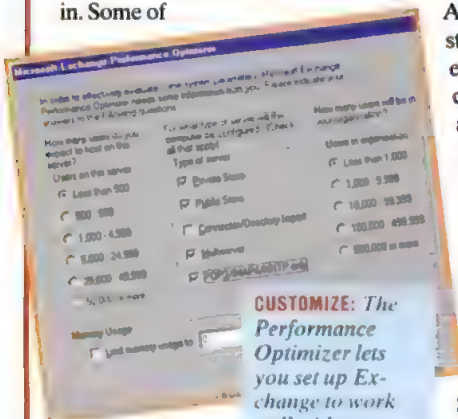


IP OF CHOICE: Exchange works with most of the popular Internet protocols, including HTTP, NNTP, SMTP, POP3, and LDAP 3.

ty any time you want, which is especially useful if your configuration changes dramatically.

MESSAGING

Some administrators think of Exchange as a new version of Microsoft Mail, and they are partially correct. Exchange's main goal is to provide e-mail to all of your users. In addition to providing



CUSTOMIZE: The Performance Optimizer lets you set up Exchange to work well with your configuration.

the more impor-

tant additions include unlimited message-store size, support for the protocols IMAP and LDAP, enhanced security, and speedy online data backup. This new version also makes it easier to perform all of the messaging and groupware tasks using Microsoft Outlook as well as your favorite Web browser.

STANDARD OR ENTERPRISE?

Exchange comes in both a Standard Edition (\$2,129 list for a 25-user license) and an Enterprise Edition (\$3,549 list for a 25-user license). Both include all of the messaging and groupware features, but the Standard Edition limits you to

Novell's GroupWise 5.2

Microsoft isn't the only company adding Web access and groupware functionality to its messaging server; Novell is working hard at it, too. The latest version of Novell GroupWise (\$715 list for a five-user license) adds Web access and several other features to entice users to upgrade. Like Exchange, GroupWise 5.2 is primarily an e-mail server, also providing some groupware applications for group scheduling, basic workflow, and keeping track of tasks. Although the ability to use a browser to connect to your GroupWise server is a welcome addition, you can't perform all tasks using the Web as you can from Novell's proprietary Windows-based client.

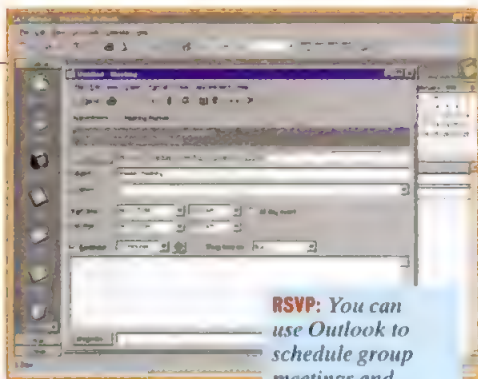
GroupWise runs on a NetWare 4.x server or higher and is tightly integrated with NetWare Directory Services (NDS). NDS is much more powerful than Windows NT's domain structure, and you can easily keep track of all of your users across a WAN. In fact, GroupWise management tasks are handled by a 32-bit snap-in to the Windows-based NWADMIN utility. From this single point of management you can define all aspects of GroupWise from post-office name to user-access rights.

Working closely with NWADMIN and the NDS tree is a nice feature, but we found a problem when we installed it using our database. Like most administrators, we were lazy and didn't enter our NetWare users' first and last names in NDS.

ceive e-mail using a browser, any Macintosh using a standard browser connected to your Exchange server can easily attach to a PROFS system.

Exchange also includes a copy of Microsoft Outlook 97, which is its client of choice for sending and receiving e-mail. You can, however, also use your own Internet e-mail client (such as Eudora) to connect to an Exchange mailbox. You can also use any Web browser to read your e-mail messages. Like Lotus Notes, Exchange keeps a copy of your messages on both your client PC and the server. Through replication, Exchange will send new messages only when you check your e-mail.

Exchange can now keep multiple copies of your address book on different servers. You can also have it replicate changes to your address book only when you connect to the server. This is helpful if you connect via a dial-up



RSVP: You can use Outlook to schedule group meetings and invite attendees via an e-mail message.

modem and have a constantly changing address book.

COLLABORATION

Messaging is definitely Exchange's strong suit, but it does include some useful collaboration utilities, such as those for group scheduling, threaded discussions, and workflow. The scheduling feature is one of the most useful of the suite, but you'll need Outlook on your client PCs to use it. Outlook provides a personal calendar that you can use to create meetings and invite participants. The scheduler can automatically determine whether people are free for a meeting by

consulting their personal calendars.

You can access the discussion database using a standard Web browser or an NNTP newsgroup reader. This lets you create bulletin board-type discussions, where users can comment on statements. All of the postings are threaded, so you can see to whom you are replying. If you need real-time discussions, Exchange bundles an IRC server. You can also use any IRC client to connect to the server. Note that the IRC server is not installed by default.

The workflow utility is useful, but you will have to learn to use the server scripting utility if you want to create your own applications. The utility can automate frequent tasks, such as submitting expense reports. Using forms, via Outlook or the Web, you can fill out an expense report and submit it; the script running on the server can look at that form, determine the amount and the sender, and submit it to the correct manager.

But although we like the workflow capabilities, they are not as robust as those found in Domino.

If you want excellent messaging and basic groupware utilities, Exchange is one of the best solutions out there. Its ability to connect to proprietary systems and the Internet means that it should fit in almost any environment. But if your goal is to design intricate groupware and intranet applications, Domino or another development package might better suit your needs.

Microsoft Exchange Server 5.5. List price: \$3,549 for 25-user Enterprise Edition; \$2,129 for 25-user Standard Edition. Server requires: Microsoft Windows NT Server 4.0 with Service Pack 3, Pentium/90 or higher CPU or Alpha 4/275 processor, 250MB hard disk space, 24MB RAM. Client requires: Pentium/60 or higher CPU, 8MB RAM (16MB for Win NT), 26MB hard disk space. Microsoft Corp., Redmond, WA; 800-426-9400, 425-882-8080; www.microsoft.com. Choose 404 at www.pcmag.com/infolink.

Instead, we gave only their log-on names, so our messages went to the correct destinations but did not have names in the "From:" fields. Though not a functional problem, it made it difficult to see who sent the message without opening it.

GroupWise supports all of the major post-office protocols, including POP3, SMTP, IMAP, and LDAP. It also provides gateways that you can use to connect your GroupWise server to other messaging systems, such as cc:Mail, MS Mail, and Lotus Notes. Unfortunately (and unlike Exchange), these gateways are not bundled with the product and cost extra.

The biggest new feature in GroupWise 5.2 is the ability to access your server using a Web browser. You can schedule appointments, send and receive e-mail, view your calendar, browse your address book, and assign tasks using Java applets or standard HTML pages. Unfortunately, not all functions are available from your browser. For example, you can create rules in the Windows client, but not from your browser. Also,



DAY PLANNER: With Novell GroupWise 5.2, you can use your Web browser to view your calendar and schedule appointments.

you can send file attachments only with Netscape Navigator 3.x or later, because GroupWise does not support file attachments with Microsoft Internet Explorer. The Java version offers more functionality and includes a resizable calendar and enhanced address-book access. Eventually, all of the client features will be available to Web users.

GroupWise doesn't have as many groupware features as Exchange, nor does it include the connectors for different e-mail systems. Nevertheless, it does integrate well with NDS and is probably your best messaging solution for networks that rely heavily on NDS and NetWare.—SR

GroupWise 5.2. List price: \$715 for five users to \$32,625 for 250 users. Server requires: Novell IntranetWare, Pentium/100 or higher CPU, 100MB hard disk space, 48MB RAM. Client requires: Pentium/100 or higher CPU, 100MB hard disk space, 32MB RAM, Netscape Navigator 3.0 or higher. Novell Inc., Orem, UT; 800-453-1267; www.novell.com/groupwise. Choose 405 at www.pcmag.com/infolink.

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First Looks

COLOR PRINTERS

Solid Ink for the Network

The Phaser 360 boosts resolution for solid-ink color printing and might pinch-hit for your network printer.

By M. David Stone

Tektronix has long been a leading manufacturer of high-end color printers. One of its more interesting technologies is the drum-based solid-ink color printer. The newest incarnation is the Phaser 360 (\$3,700 street), which is essentially a beefed-up version of the Phaser 350 (reviewed in "Clean, Crisp... and Color!", October 21, 1997). New features include a faster processor, a standard 10Base-T Ethernet adapter, and—most importantly—a new resolution of 800-by-450 dpi that offers a noticeable improvement in image quality.

PRINTING SPEED

The Phaser 360 claims just a 6-ppm (page-per-minute) speed in its draft mode and 4 ppm in standard mode, but Tektronix stresses that as a network printer the Phaser 360 can serve the same role as a 24-ppm monochrome printer (in at least some offices) and offer color as a bonus. Tektronix claims the vast majority of output on networks consists of one- or two-page letters and the like and that the Phaser 360 can print one page as fast as an average network printer.

On our tests, the Phaser 360 managed a one-page letter in 25 seconds in standard mode. As a point of reference, a 24-ppm Lexmark Optra N printed the same letter in 19 seconds. That's not slow enough to be an issue. Nevertheless, the gap widens with more pages. We clocked the Phaser 360 at 38 seconds for two pages (compared to 21 sec-

onds with the Lexmark). Our standard 12-page Microsoft Word document took about 3 minutes 10 seconds.

PRINT QUALITY

Output quality varies noticeably with print mode. Mono-



HOT INK: The Phaser 360's solid ink produces brilliant color output.

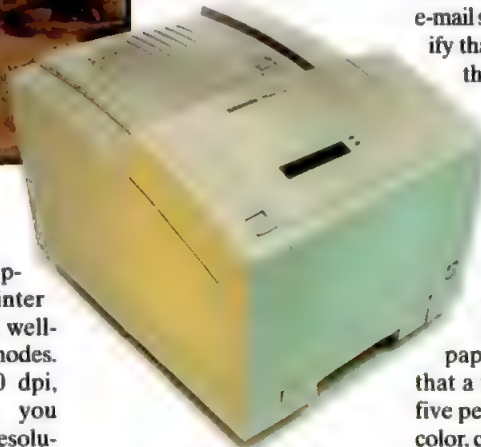
chrome text quality is appropriate for the printer resolution, with sharp, well-formed characters in all modes. Standard mode, at 300 dpi, shows the graininess you would expect from that resolution for both monochrome and color graphics and photos, but it still offers sharp, well-defined thin lines and edges. Fast color mode, at a lower resolution (which Tektronix won't specify) and larger dots, is grainier still, but it's suitable for a draft mode. Enhanced mode (at 800-by-450 dpi) shows a much more subtle graininess, which you could miss at a casual glance. And, of course, color output offers the brilliance and full saturation that solid-ink printers are known for.

EASY SETUP

Setting up the Phaser 360 involves little more than turning a screw to release the print head from its shipping position, in-

stalling the 250-sheet letter-size paper tray, and sliding in the maintenance tray, which provides a bin for catching unused ink. The unit comes with ink already loaded, although you can add more by lifting the top cover and sliding the cyan, magenta, yellow, and black blocks of ink into the appropriate slots.

Be aware that when you first turn on the printer—and any time you turn it off long enough for the ink to solidify—you have to wait about 15 minutes for the ink to melt. Tektronix recommends simply leaving it on continuously. The first time you plug it in, you can use the warm-



up time to install the printer on the network.

NETWORK INSTALLATION

Setting up on a network is reasonably standard fare. With NetWare 4.11, for example, you follow the usual NetWare setup steps, load the Tektronix PhaserShare Administrator, select the Phaser 360 from the list of printers, choose Configure Printer, and work your way through the settings.

Alternatively, after entering the NetWare settings you can set an IP address for the printer through its front panel, use your Web browser to connect to the printer through its built-in PhaserLink feature, and use the options on the printer's built-in Web pages to set the configura-

tion. If you're familiar with your network settings, neither approach should take more than a few minutes.

Aside from the PhaserShare Administrator and PhaserLink, you won't find much in the way of network support. Queue management is limited to network and operating system tools. PhaserLink provides a status page that you can view with a browser, but you have to update the status manually.

You can also use PhaserShare Administrator or PhaserLink to set the printer to send e-mail status messages (reporting everything from paper jams to engine failures) to any users you specify. Nonetheless, you need a POP3 e-mail server, and you can't specify that messages should go to the particular user whose print job it is.

PRINTING COSTS

Finally, the Phaser 360 is relatively inexpensive to run. Black ink is free, which means monochrome output costs the price of the paper. Tektronix estimates that a typical color page, with five percent coverage for each color, costs six cents in standard mode or eight cents in enhanced mode.

Tektronix's point about speed for one- or two-page documents makes good sense. Ultimately, the slow speed for printing longer documents means you probably won't want the Phaser 360 as your only network printer. But its combination of speed and quality will allow it to serve as a switch-hitter for both color output and as an additional network printer for short monochrome documents as well.

Phaser 360. Street price: \$3,700. Requires: Parallel port or 10Base-T Ethernet connection. Tektronix Inc., Wilsonville, OR; 800-835-6100, fax: 503-682-2980; www.tek.com/Color_Printers. Choose 407 at www.pcmag.com/infolink.



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First Looks

PERIPHERALS

Scanning the Entry Level

The HP ScanJet 5100C flatbed scanner makes it easy to get top-quality image scans on a budget.

By Bruce Brown

The new HP ScanJet 5100C (\$300 street) replaces the HP ScanJet 5P, bringing several new features and capabilities to the entry-level scanner arena. The 5100C's ease of installation and use as well as improved image analysis may all but assure HP's dominance in the scanner market.

The 4.9- by 12- by 19.1-inch (HWD) ScanJet 5100C has a maximum document scanning size of 8.5 by 11.7 inches. The optical resolution is 300 dpi, with interpolation from 12 to 1,200 dpi. The scanner's new IST (Intelligent Scanning Technology), based on 36-bit color processing, includes several elements that speed up and simplify scanning while producing very clear images.

The unit's features include simultaneous dual-image scanning, automatic complex page analysis, line-art enhancement, and page-format protection. Dual-image scanning saves time by performing two scans at once after automatic page analysis. For example, if a source page contains text and color-photo images, the 5100C would capture both during a single scan using dual data paths.

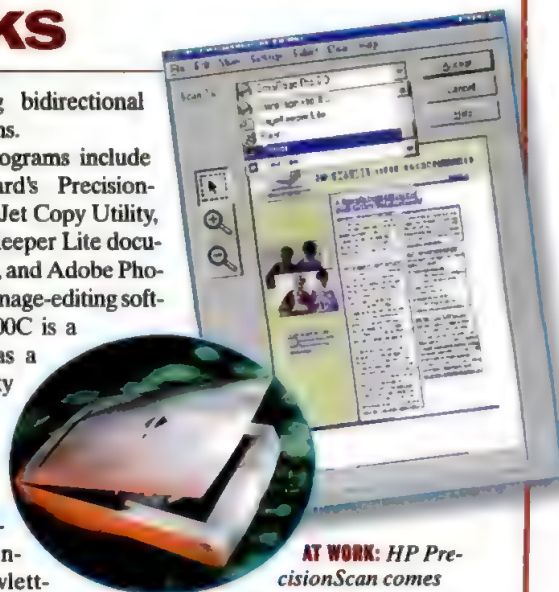
IST transforms line-art images into scalable vector-image files to lessen the jaggedness of bitmapped line scans. It also adjusts exposure and sharpness of scanned black-and-white and color photo images. Page protection works by identifying and maintaining the relative size, placement, and alignment of various page elements to preserve the layout for editing in most word processing programs.

The scanner plugs into a parallel printer port and has a pass-through on the back into which you can plug your parallel-port printer. When an initial test did not work correctly (probably due to a loose cable), faulty power recycling in the scanner kept the system from seeing an HP PhotoSmart Printer attached via the scanner to the test PC until the whole system was powered down. HP has also discovered that the 5100C's printer pass-through doesn't work correctly with its own DeskJet 690 series

printers using bidirectional communications.

Bundled programs include Hewlett-Packard's PrecisionScan and ScanJet Copy Utility, Caere's PageKeeper Lite document manager, and Adobe PhotoDeluxe 2.0 image-editing software. The 5100C is a great choice as a starter or utility scanner.

HP ScanJet 5100C. Street price: \$300. Requires: Microsoft Windows 95. Hewlett-Packard Co., Palo Alto, CA; 800-722-6538, fax: 800-333-1917; www.hp.com/go/scanjet. Choose 408 at www.pcmag.com/infolink.



AT WORK: HP PrecisionScan comes bundled with the HP ScanJet 5100C. You are able to select specific elements from an image scan to be sent directly to an application, a file, or a connected printer.

PERIPHERALS

A Lighter Focus

The In Focus LP420 uses Digital Light Processing technology to create a high-quality, truly portable projector.

By Alfred Poor

In Focus, the leading manufacturer of portable projectors, just may extend its lead on the market with its newest offering. The In Focus LP420 is a tiny, 6.8-pound SVGA projector that produces a brighter image than projectors weighing twice as much. And with a list price of \$5,999, it

claimed 500 ANSI lumens image that makes it useful in a room with normal lighting. The In Focus is the first lightweight projector to use DLP (Digital Light Processing) technology, which is based on micromirror chips from Texas Instruments. In Focus designed its own projection engine around the chip, including light source and optics, which made it possible to create a much smaller and lighter projector than previous DLP designs.

The unit is easy to set up using a cable to connect to your PC's video output and a separate sound cable. If you want video loop-through or mouse support, you can buy the In Focus Cable Wizard (\$225). There are also optional remote controls available.

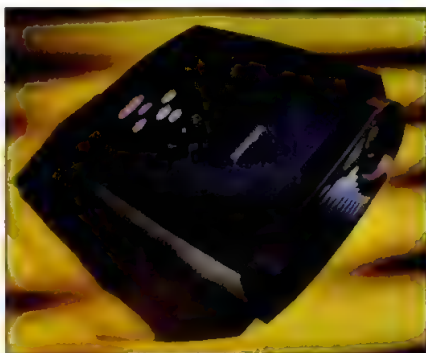
On our tests, the projector had a fairly wide throw, so it needed to be closer to the screen than other projectors. The optics were

good, but there was some noticeable curvature of the image at the top and side edges. Our unit also had considerable light leakage along the front bottom edge, but according to the vendor, it has added additional masking.

Using test-measure procedures based on the ANSI protocol, we measured the output at 393 lumens, which compares favorably with other projectors with similar ratings (for more information, see "Lighter and Brighter," August 1997). The image contrast was good with a 79:1 ratio, though the uniformity score was a high 2.4, with the screen noticeably brighter down the middle than at the sides or in the corners. The projected images were excellent and stable, with good colors and bandwidth and no streaking or ghosting.

As projector makers begin to market their products through retail channels, more personal projectors under 10 pounds will appear. The In Focus LP420 has set a high standard, and it is clearly the one to beat.

In Focus LP420. List price: \$5,999. In Focus, Wilsonville, OR; 800-294-6400, 503-685-8888; www.infocus.com. Choose 409 at www.pcmag.com/infolink.



costs less than many other projectors as well.

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- ELSA Gloria-L Video Card
- 4x/6x Yamaha Recordable CD-ROM
- Iomega Jaz Drive
- Iomega Ditto™ 3200 Tape Drive
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First Looks

COMMUNICATIONS SERVERS

Get to the Net

Bay Networks' Instant Internet 100 will get your IPX LAN clients online in short and easy order.

By Les Freed

It's an increasingly IP world, but there are still plenty of IPX-only LANs out there. Bay Networks' Instant Internet 100 (\$750 street for the 33.6 Kbps version and \$950 street for the ISDN and 56K versions) is an IPX-to-Internet gateway that provides a fast, easy way to add Internet access to your IPX LAN—without installing IP on each desktop machine. If you already have IP installed on your LAN, Instant Internet can act as a SOCKS proxy server and firewall to provide protected Internet access for your IP-enabled clients.

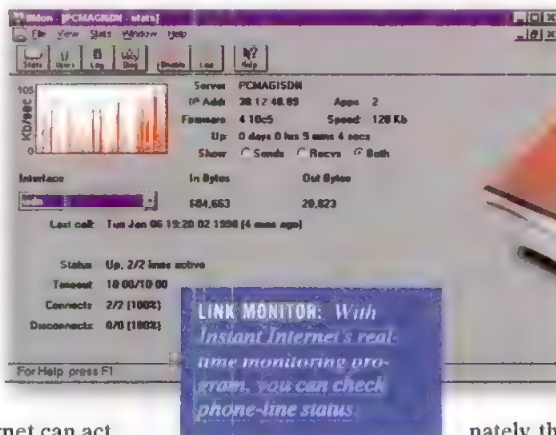
Because the Instant Internet client software talks to the Instant Internet hardware via IPX, there's no need to install TCP/IP on each client machine, and there's no IP addressing headaches, either. The IP Internet traffic begins and ends at the Instant Internet box, so there's no way a hacker can gain access to your LAN via the Internet.

NEAR-INstant INSTALL

Instant Internet comes in several models, providing your choice of v.34, x2, or ISDN (or T1 with Instant Internet 400) connections to your Internet Service Provider (we tested the x2 and ISDN versions for this review). Other than the communications interface, all the products are functionally identical. The Instant Internet hardware looks like an oversized modem, with eight status

LEDs on the front and 10Base-T, AUI, and phone-line connectors on the rear panel.

Instant Internet's installation process isn't really "instant," but it's pretty close.



First, you connect the LAN, phone line, and power connectors to the Instant Internet box and power it on. The Instant Internet box watches your LAN traffic and automatically learns the correct Ethernet frame type for your LAN. Next, you run the Instant Internet installer from any IPX-connected workstation. The first time you run the installer, it makes a copy of itself and a suite of Internet application programs on a shared LAN directory.

Once you've created the master files on the LAN, the Instant Internet setup program guides you through the process of entering your ISP and ISDN information. It then places a test call to your ISP to make sure everything is working correctly. In most cases, all you need to

know is the phone number and account information for your ISP account. Instant Internet can operate with either static or dynamic IP addressing, so you do not need a special—and often expensive—router account with your ISP.

Once you've configured and tested the Instant Internet hardware, you install the Instant Internet software onto each PC that will require access to

PUTTING IT TO WORK

In day-to-day use, Instant Internet operates much like an IP router connected to a dial-up link. Users do not have to do anything special to bring the link up or down; Instant Internet automatically dials and disconnects from your ISP as needed. We did notice that the x2 model takes noticeably longer to connect than the ISDN model. ISDN calls typically connect in less than half a second, while x2 protocol negotiation can take 10 seconds or more.

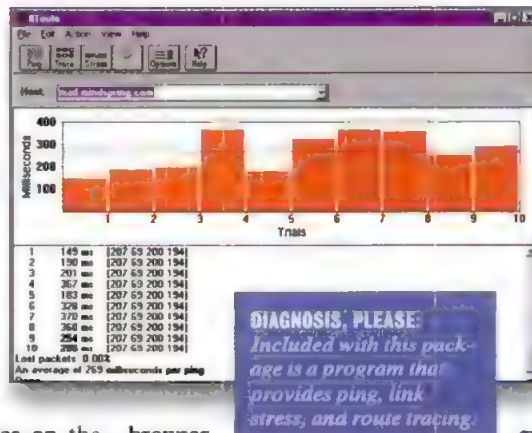
Instant Internet comes with a suite of diagnostic and monitoring tools, including an excellent IP diagnostic that provides ping, link stress, and route-tracing functions in one program. A real-time monitoring program lets you check the status of the ISDN or phone link from any workstation, and a user-manager program lets you restrict access to specific users or groups. The program can obtain user information from the NetWare Bindery or from an NDS server (as well as Windows NT directory services), so you don't have to keep a separate database of Instant Internet users.

Bay Networks provides a license for 20 concurrent user applications; extra users can be added via upgrade packs. Instant Internet operates as a standalone gateway, so it does not use any server resources and will operate with any IPX-based LAN.

If you need to get your IPX LAN clients onto the Internet, Instant Internet is a great, affordable solution.

Instant Internet 100. Street price: \$750 (33.6 Kbps version), \$950 (ISDN and 56K versions). Bay Networks Inc., San Antonio, TX; 800-435-7784, 201-979-2100 www.baynetworks.com. Choose 406 at www.pcmag.com/infolink.

the shared Internet connection. Fortunately, this process takes only a few minutes per PC. As part of the client installation process, you can optionally install any or all of a suite of provided Internet access applications, including Eudora Light, the WinVN newsreader, and the WinWeb



browser.

The client installer program also installs a customized Winsock, so you can use Instant Internet with virtually any Winsock-compliant application, including Netscape Communicator and Navigator and Microsoft Internet Explorer.



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First Looks

STATISTICAL SOFTWARE

Stats for the Pros

Boasting a new graphics engine and interface scripting, SPSS Version 8.0 improves on a classic.

By Barry Simon

Last year's Version 7 of statistics powerhouse SPSS is a tough act to follow. It added ease of use to SPSS's statistical muscle and moved the program to a 32-bit Windows 95 interface. But the new SPSS 8.0 for Windows (\$795 list) meets the challenge by substantially reworking the graphics engine, enhancing access to and analysis of data, and vastly improving help files.

GRAPHICS IMPROVEMENTS

Graphs are a great means of observing how one variable depends on another, and using SPSS's new interactive graph engine is a unique and simple way to do so. Using variables to affect color coding, symbol size, or point style in a scatter plot is as easy as dragging and dropping variables from a list to the right entry in a dialog box.

SPSS's graph customization possibilities are spectacular. For example, you can texture bar charts with any bitmap, including currency and any other symbols. You can also draw a set of pie charts that will let you see the spread of one variable as a function of two others.

Although the customization features are impressive, their interface leaves a lot to be desired. For creating a bar graph, the Choose Variables dialog box has a drop-down menu from which to pick the statistic. But once you've created the graph, that menu is no longer in the dialog box; instead, it is accessible from a dialog you reach by double-clicking on the bars in the graph.

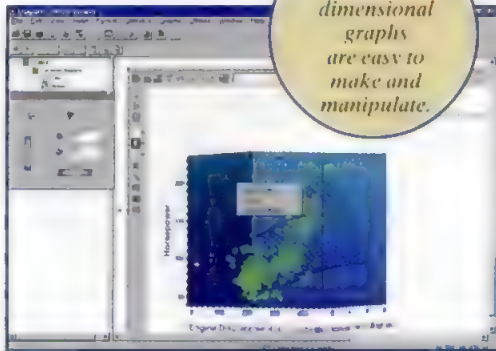
There are too many places to search for customization. Some choices are on right-click menus and others in dialog boxes you reach by double-clicking. Still others are accessible via toolbars that surround a graph or via one of several tool palettes. The result is a bit of a muddle: It's all there, but occasional users will need to search around to find the necessary controls. SPSS would be well-advised to look at Sigma Plot (recently acquired by SPSS), which places most customization options in one dialog box with tabs reached through a graphical submenu.

DATA ACQUISITION AND ANALYSIS

Although the customization interface is lacking, the data-acquisition interface is a model of intelligent design. An ODBC data wizard leads you through your source choices,

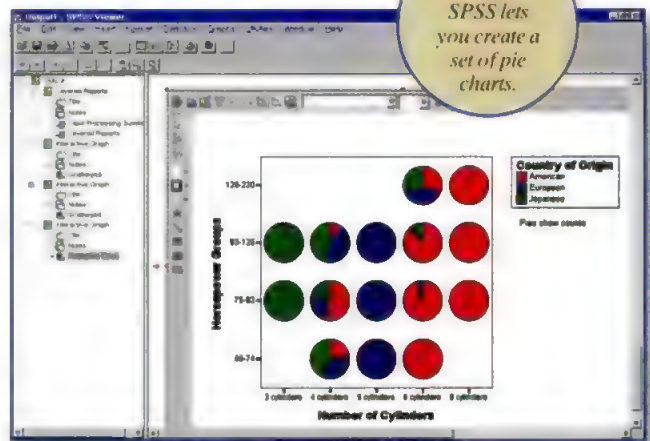
displaying tables and variables in

ALL ANGLES:
Three-dimensional graphs are easy to make and manipulate.



a way that makes it easy to pick the data you want and the order in which you want it.

New to Version 8.0 is a wonderful tool called the Layered Report. It lets you display statistics—depending on variables—in rows, columns, and drop-down lists, so that changing layers is as easy as picking



from a drop-down menu. You change which variables are in which group via the elegant pivot-table tray tool, which SPSS introduced in the last version of this program. You can even save a choice of variables and layers in a bookmark and easily switch between views of your data.

Three new help elements make data analysis easier. In addition to the usual contents/index/search features, the main help file has a natural-language engine called Ask Me. A Statistics Coach presents a wizard to

help you choose among the myriad statistical tests that the program supplies. A Results Coach gives you an overview of the elements in tabular or graphical form.

INTERFACE CUSTOMIZATION

SPSS uses multiple window types for manipulating data, displaying output, and editing various scripting languages. Each window comes with a variety of toolbars, and you can customize or even add to them. You can also customize menus (although not as extensively), and you can add a menu item for sending data to an external program.

SPSS has long had a powerful underlying data-manipulation

language, and for many years the program was accessible only by writing scripts in its native language. The vendor has since added a Basic-like scripting language that lets you automate the choice of colors in a table or add your own custom dialog boxes. The program includes a color-coded script editor with a debugger and a dialog editor reminiscent of the Visual Basic 4.0 environment. But it is very puzzling that SPSS has not licensed VBA, so that the more powerful editor Visual Basic 5.0 could be available for scripts.

When the King of Egypt asked the astronomer Ptolemy for an easy way to learn Euclidean geometry, Ptolemy reputedly replied, "There is no royal road to geometry." In one sense the same is true for statistics. Although SPSS will coach you on which procedures to use, the product requires some statistical expertise beyond the ability to understand variable counts and means. But SPSS has done a wonderful job of giving those who know basic statistics a royal road to accomplishing their tasks.

SPSS 8.0 for Windows. List price: \$795. Requires: Microsoft Windows 95 or NT 4.0, 486/50 CPU or higher, 16MB RAM, 40MB hard disk space. SPSS Inc., Chicago, IL; 800-543-2185; www.spss.com. Choose 402 at www.pcmag.com/infolink.

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Second Looks

COMPAQ PC THEATRE, GATEWAY DESTINATION

Back to the Couch

By Bruce Brown

A lot has changed since our last roundup of PC/TVs (for more information, see First Looks, August 1997), including some very recent upgrades to big-screen PC/TV models from Compaq Computer Corp. and Gateway 2000. These changes underscore the behemoths' entertainment value, especially now that DVD-ROM movies are readily available in the consumer market. The Compaq PC Theatre (\$5,300 estimated street) and the Gateway Destination D6-300XL (\$4,999 direct) both now include DVD-ROM II drives and 36-inch PC/TV monitors in their respective lists of peripherals and features.

The Compaq PC Theatre is still sold in only four cities in the United States (contact Compaq directly at 800-652-6672 for locations), making it harder to find than the Gateway system, which is sold direct via telephone (800-846-2000) and the company's Web site (www.gw2k.com) and in Gateway's Country stores. If you're a lucky consumer contemplating the purchase of a new computer, a big-screen TV, and a DVD player, either of these admittedly costly systems can make an impressive addition to a family entertainment center.

Both PC/TVs now also have multiple rear- and front-mounted audio and video inputs, 56-Kbps modems, internal TV tuners, well-designed wireless keyboards with integral pointing devices, and oversize remote controllers with trackballs.

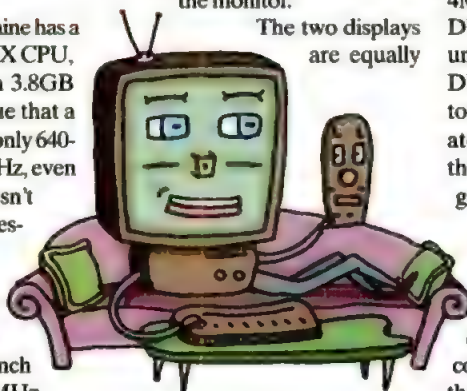
The Compaq PC Theatre, offered in only one configuration, is less well equipped for high-powered computing than the Destina-

tion. The Compaq machine has a 200-MHz Pentium MMX CPU, 40MB of RAM, and a 3.8GB hard disk; one can argue that a home PC that displays only 640-by-480 resolution at 60 Hz, even on a huge screen, doesn't need a heavy-duty processor.

The Destination, available in multiple configurations for as little as \$2,499 with a 31-inch screen, boasts a 300-MHz Pentium II CPU in the configuration we tested, plus 64MB of RAM and an 8.4GB hard disk. The Destination's bundle includes a Harmon-Kardon Dolby

ProLogic receiver along with a six-piece home-theater speaker system, while the Compaq unit uses speakers that are built into the monitor.

The two displays are equally



impressive, with bright pictures and rich colors. They are adjusted via software.

In displaying films from several studios in DVD format, both

machines did a great job, with no delays or blurring; notably, each uses a Chromatic Research Mpack Media processor with 4MB of memory to enhance the DVD viewing experience. Both units passed a crucial test of DVD II drives: They were able to read the contents of a disk created with a CD-R drive, a feat that's not possible with first-generation DVD drives.

YOUR BEST BET

While either system can provide an abundance of entertainment, Internet, and computing experiences, now that the tube sizes are equal, the Destination D6-300XL is the better value, with more raw computing power and storage, a better audio setup, a slightly lower price, and wider availability.

TOSHIBA INFANIA

We've Got You Covered

By Nancy Hirsch

When we awarded the Toshiba Infania 7620 our Editors' Choice in the December 16, 1997, home PC roundup, we expected that a lot of people would take a new

out technical support.

To assuage these customers' fears, Toshiba will provide additional optional support packages. The vendor is offering three extensions to the Infania's standard warranty of 90 days on-site and one year carry-in: Customers can now purchase one year of additional next-day, on-site service for \$89. Two years costs \$179; three years, \$299.

Toshiba is also offering an option to extend its toll-free technical support any time after the first year's standard coverage has expired. One or two years of additional technical support is \$69 per year. (Technical support is available only during the first three years of ownership.) Users can sign up for these



Infania home. But the recent announcement that the vendor has decided to pull out of the consumer desktop market may have some new Infania owners concerned about being left with-

packages at Toshiba's Web site (<http://pcsupport.toshiba.com>) or by calling 800-334-3445.

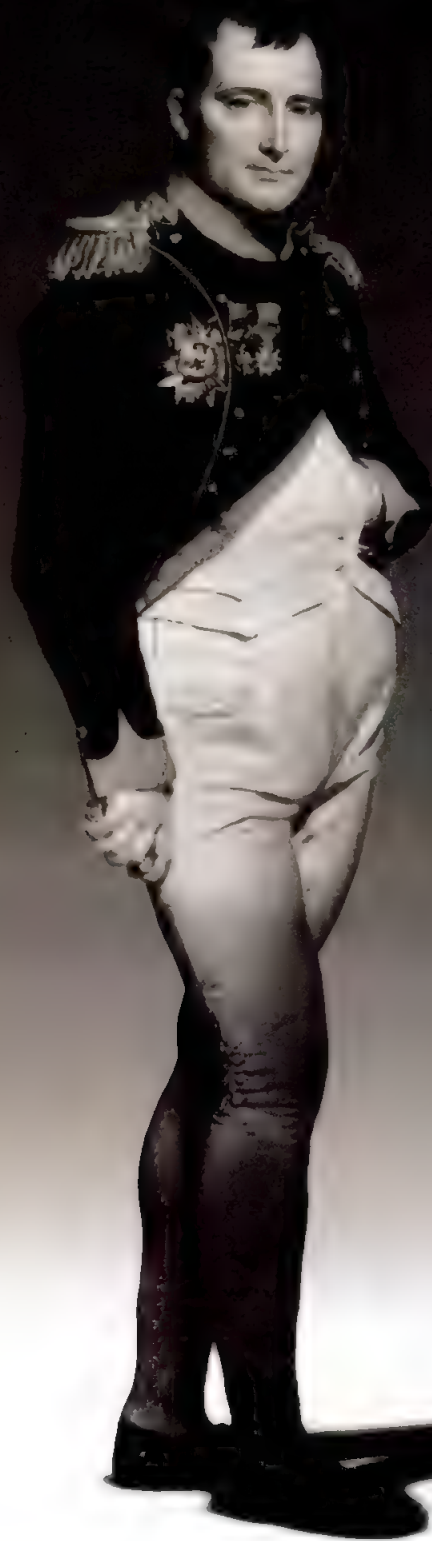
BACKING IT ALL UP

Toshiba has also sweetened the deal for Infania owners by introducing two online data backup packages. These online programs allow you to store your data in Toshiba's secure data storage center automatically. Once you set up a schedule to back up your data, Toshiba's Online Backup will automatically double-encrypt, send, and store the selected files. There is also an option to retrieve any version of the stored data, not just the one that was most recently backed up.

The basic program is available for \$24.50 per month and includes an unlimited number of data backups for files of any size. Backup Plus adds virus scans and quarterly CD-ROM copies of backed-up files for \$29.50 per month.

SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Carol Venezia at cvenezia@zd.com.

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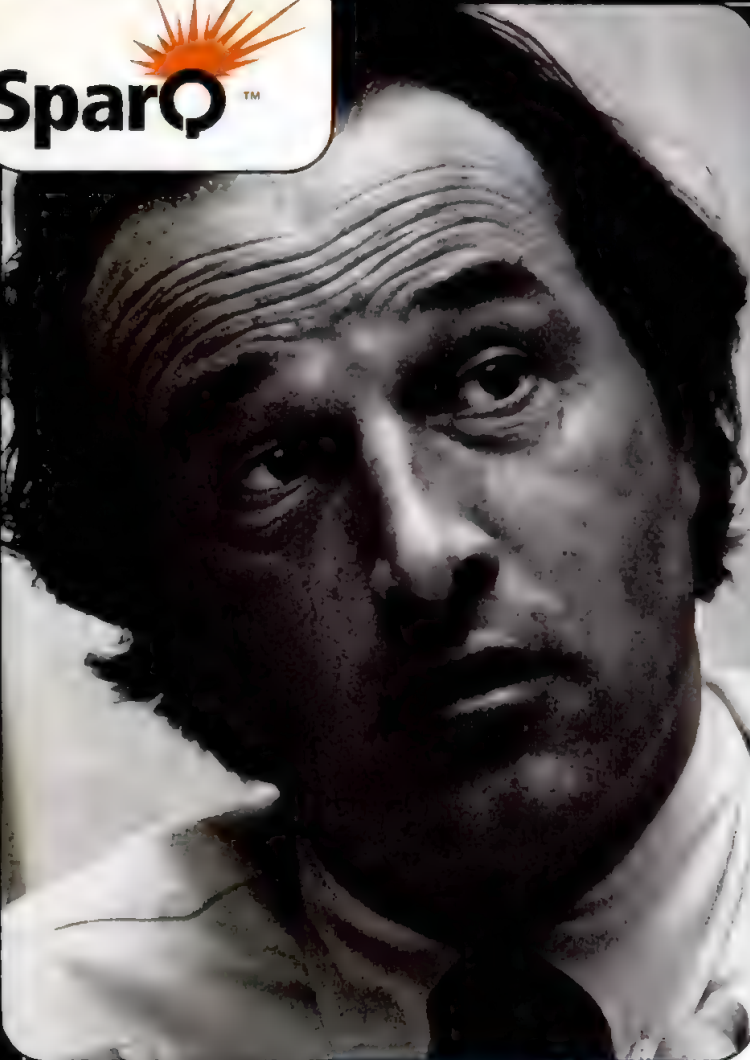
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The Next Great User Interface

Everybody loves to hate the Windows user interface (UI). It has lots of easy targets, from the inconsistencies of when to single-click and when to double-click, to when cascading menus are sticky and when they're not, to when and where you can use keyboard

shortcuts. Still, it gets the job done. Windows 95 was supposed to cure many UI ills but instead introduced new ones or simply made things different, not better.

The Windows UI is a fairly direct descendant of the granddaddy of all graphical user interfaces, the one created for the Star at Xerox's Palo Alto Research Center. The Macintosh refined and popularized it, and Bill Gates realized early on that rich, bitmapped screens with point-and-click interactivity were essential to the ultimate taming and widespread popularity of the personal computer. Does Microsoft's now-unquestioned dominance mean that we're dependent on Redmond for all advances in user interfaces? Not at all. Innovations can be found at the user level in many programs. Here are some interesting examples.

Ignoring the Windows UI is almost a religious issue for MetaCreations, the publisher of programs such as Kai's Power GOO, Kai's Photo Soap, and Art Dabbler. MetaCreations' programs are distinguished by drawers that slide out, filled with tool icons and cursors that look like the tools they represent: brushes, erasers, and pencils. Almost nothing is labeled, and you learn mostly by doing. Kai's programs don't have so much as a single pull-down menu in sight, while Art Dabbler gives at least a passing nod to Windows conventions.

These programs can be tremendously productive in creating original art and modifying photographs, but only at the cost of considerable time and not a little frustration while you learn the functions of the icons. Still, they show what's possible in terms of simulating real-world tools.

One unlikely innovator is HoTMetaL PRO 4.0, a comprehensive HTML authoring package from SoftQuad. Information Manager, its site management tool, gives a visual display of your site that's dramatically different from the usual tools found in Web project management software.

Information Manager maps all of the files and links onto an invisible spherical surface. As you grab various areas of your site with the cursor and bring them to the center of the window, you see more and more linked pages and files.

Other areas of the site, the ones you're not interested in at the moment, automatically compress themselves. A quick grab on some distant part of the site instantly brings it and its subordinate links into prominence. All this happens in real time, as you move the mouse. The interface is intuitive and

useful, far more than any hierarchical list could be. You can try HoTMetaL PRO 4.0 at www.softquad.com.

The 3-D idea is not entirely new, however. An old Macintosh-based data analysis program called MacSpin was the first to use a 3-D metaphor for displaying data. It let you take any three variables from a database and map them as points in a three-dimensional space. You could rotate the cloud of dots, look for clusters or anomalies, then click on a dot or group of dots to get more information.

Microsoft is constantly working on new user interfaces, too, especially in the areas of voice recognition and text-to-speech. You can see the current state of the art at www.microsoft.com/intdev/agent. If you're running Internet Explorer and Windows 95 or NT, it's worth downloading the Agent core and some of the demo files. These reveal the approach's great potential not only for Web interactivity but also for everyday tasks such as animated help files and step-by-step guides for the uninitiated as well.

Of course, not all UI changes represent progress. Microsoft's Active Desktop and Netscape's channel architecture/push technology are both serious

cases of user abuse. Push technology, with the possible exception of PointCast and some intranet apps, is the answer to a question nobody is asking (except rapacious marketers).

Some old ideas are just too good to throw away. For instance, Micro Logic's Info Select lets you press a single mnemonic key, such as N for *new* and E for *edit*; this practice goes all the way back to its earliest incarnation as Tornado Notes. No Alt keys, no Ctrl keys, nothing to slow you down. Micro Logic also publishes DiskMapper, one of the most innovative ways of displaying file information. There aren't any demos at www.mailog.com, but you'll find plenty of detailed information on both programs. **PC**



LATERAL THINKING
Ignoring the Windows UI is almost a religious issue for some software developers.



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Is That a Computer in Your Pocket?

The cycle of computing is closing for the clunky desktop computer. Only direct sales and low profit margins have kept it alive. Most smart users have switched to laptops with port replicators or docking stations, and if laptop prices were more competitive it's

likely that the desktop would already be dead.

The laptop is not the end point of personal computing. The system of the future is a small, Pilot-like device that does everything in a single, compact unit. It will incorporate a complete computer system with hard disk as well as cell phone or radio modem, GPS, digital camera, voice recorder, and anything else that can be crammed in. It will plop into a carrier when needed as the CPU for a workstation. Built into this carrier will be connectors for a keyboard, monitor, mouse, and other I/O options.

All this and more could be built today at considerable cost, but there is every indication that such a device will eventually replace today's bulky machines. Today's desktop and laptop computers are the dinosaurs of the future.

Though I can go on for hours about this futuristic device, what fetters me is the lack of an appropriate name for this thing. The term *microcomputer* would be appropriate if it had not been used and finally rejected in the late 1970s and early 1980s in favor of *personal computer*. Bill Gates tried to call such a device the "wallet computer" a few years back, and I believe he still uses that term. But it's an awful name for something that has nothing to do with wallets and is unlikely ever to be put in a back pocket.

The fact is that few developments in computing are ever successful unless they are given a cool name that makes people take notice. Throughout the history of computing, all successful major changes in the business have been marked by new and jazzy names. *Word processing*, which was explanatory but not jazzy, did not trigger interest as much as *spreadsheet* did, which was also explanatory but jazzier (at least to accountants). *VisiCalc* was really jazzy, and the name itself triggered a revolution. Even the most boring change had a designation—even if it was slightly dreary—for example, the term *subnotebook*. The Palm Pilot, from U.S. Robotics, is a step in the right direction, but there is no good name for the group of products it represents. Some people call them *palmtops* (which has never caught on) or *vest-pocket organizers*. I'm reminded of a clueless Taiwanese manu-

facturer that was about to bring out a palmtop called the Hand Job. Luckily, the U.S. marketeers caught the dubious nomenclature before the product shipped.

If smaller devices are eventually going to replace our large desktop monsters, we have to come up with an appropriate name (other than a *whatchamacallit*). I actually prefer *whatchamacallit* to the current *PDA* or *personal digital assistant*. These things are no more of an "assistant" than a date book or a fountain pen is. *PDA* is a bad name that I believe was drummed up by Apple when it was promoting the Newton. The Newton was too little too early, and the name *PDA* made it worse. "Pee Dee Aye" just sounds bad, and I believe it was as responsible for the Newton's mediocre showing as anything else.

I like the name *pico computer* or *pico device*. The industry as a whole has avoided the *milli* prefix, as in *millicomputer*. Recently, Digital named a new online small-transaction system *Millicent*, so it may be something that is about to catch on. *Meta* is another prefix that floats around both New Age and programming circles but has never jumped the fence into the world of computer hardware: the *metacomputer*. Some people promote the prefix *macro*: the *macrocomputer*. This has a nice ring, but the public doesn't know what *macro* really means. And *macro* is now associated with an antivirus crusade, as in "the Microsoft Word macro viruses."

Then we have the word *personal*, which has fallen a bit by the wayside in favor of *desktop* or *laptop*, *notebook*, and *workstation*. The term *personal organizer* is around, but it doesn't correctly describe a powerful computer. If you call one of these things a *pocket computer*, I could live with that. This device could eventually evolve into a *card computer*—a complete system built into a smart card. Although *pocket computing* invites various lewd jokes, it has a certain descriptive charm and follows the line of reasoning that led to the terms *desktop computing* and *laptop computing*. So until someone comes along with a better term for a small device that fits into a pocket, I'm sticking with *pocket computer*.



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Inside Track

While Intel and the rest of the gang slowly **increase performance** and attempt to introduce new features like extended MMX or MMX/2, a **curious** development seems to have taken place in Japan that may forever obliterate Moore's Law. This would be great, since Moore's Law (which says that performance *née* transistor count *née* who-knows-what will double every 18 months or so) and references to Moore's Law are **getting on my nerves**.

Fujitsu Labs, in conjunction with Kyoto University, presented a paper about a **new manufacturing process** called **cluster implantation**, in which ion beams are used to create a 0.05-micron chip technology. Apparently cluster implantation has been in the experimental stage for some time, but new tricks make volume production viable. Japan's Ministry of International Trade and Industry will fund the development of this process, with volume production projected for around 2002. That's significant, because according to Moore's Law the industry isn't expected to achieve this level of development until 2012. Cluster implantation will be used to produce 256-gigabit DRAMs. The result will be either a **fantastic breakthrough or a complete fiasco**. Nevertheless, the Japanese seem intent on proving Moore's Law wrong. Exactly how the industry will employ the forthcoming gobs and gobs of memory is unknown, but it makes my notions about **pocket computers** seem more logical.

Japan Inc. Strikes Again Dept.: In the world of computers, when something new comes along, it usually gets into the mainstream as fast as it can be manufactured. Each company tries to **kill off** its competition. In consumer electronics, this is less true, especially with technologies coming from Japan to the United States. I mention this only to point out the annoying fact that we've passed Christmas 1997 without seeing the digital D-VHS deck in any quantity. That is because, in a **quiet conspiracy**, the Japanese consumer electronic firms decided to promote DVD to a public that simply isn't interested. This commiserar approach to economics does nothing more than get these companies (and Japan itself) into various economic binds. As Asian economies fall apart, we can look to the D-VHS deck (which I predict will be a resounding success) as a symbol of the problem. **I want my D-VHS!**

So what's the latest in the DVD format wars? The current **battle** for the rewritable championship has split into five distinct camps. There's the official **CD-RW proposal**, which everyone is ignoring. Then there is **DVD-RAM**, which Matsushita is sticking with if only because it's compatible with Matsushita's CD-PD device in some way. Then there is the **DVD+RW**, which Sony and Philips have

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agreed on. They claim it's a logical extension of the original CD-RW. Long shots include the NEC proposal for something called **DVD-MMVFF** (Multimedia Video File Format), which should lose because of its moniker alone. And finally there is **DVD-R/W**, promoted by Pioneer. So, as you can tell, we can expect to see rewritable devices on the market any minute. Not!

Since Sony and Philips essentially invented the CD formats and the device itself, I'd bank on their **winning**. Companies that support the DVD+RW format include HP, Mitsubishi, Ricoh, and Yamaha. Sample devices are expected in mid-1998. Since DVD+RW emphasizes data storage,

not video, products based on this technology will find success as internal devices. DVD+RW **records 3GB** per side in a caddyless player and supports DVD-ROM, DVD-R, DVD-Movie, CD-ROM, CD-R, CD-RW, and CD-Audio.

The DVD-RAM format, while having the support of Hitachi, Matsushita, and Toshiba, as well as other big names, will lose this war. DVD-RAM **records only 2.6GB** per side and requires a caddy, which people have come to hate. Its only advantage over the Sony/Philips device is that it supports the CD-PD. Big deal.

The DVD-R/W, from Pioneer, is also caddyless. It will record a **substantial 3.95GB** per side, with claimed superior error correction. But this format seems doomed for political reasons if nothing else. Also, the blank disks are twice as expensive, and the drive will reportedly cost a fortune. The big advantage of the Pioneer format is that a recorded disk will play on a vanilla DVD drive. NEC remains the sleeper, as its DVD-MMVFF claims a **whopping 5.2GB per side**. Details are scant.

Consumers should be **bargain-hunting** for so-called **MFPs** (multifunction peripherals), which can print, scan, copy, and fax, since a **glut** seems to have hit the industry. What amuses me is that the industry seems to be blaming the glut on a perceived increase in sales for cheap fax machines. This may not be correct.

When the idea of the MFP was first discussed over a decade ago, I believed the problem with such an invention was that when one thing went wrong with one aspect of the device, the entire unit would become **useless**. In fact, this analysis has proved wrong over the long term, when component reliability negated this fear. The **desktop space saving** alone justified the innovation. But now, because of the sudden popularity of the photo-quality printer, people see the MFP as incomplete. If they have to go buy yet another printer for true **photo-quality** prints, then why bother with an MFP? The subtle move by the computer-using public into digital photography is what's affecting this market. It's not the fax machine that's causing the problem. **PC**

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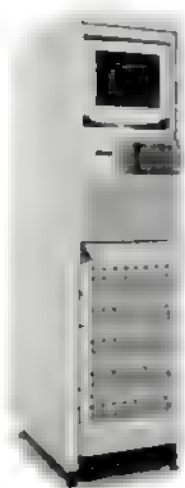
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Sub-\$1,000 PCs Go to Work

Good enough for home? Sure. Good enough for the office? Why do you ask? The avalanche of “under-\$1,000” PCs redefined the consumer PC business last November and December. By some estimates, the sub-\$1,000 PC constituted as much as 50 percent of

the computer sales at retailers such as Best Buy, Circuit City, and CompUSA. That “under a thousand dollars” line got stretched a little—few of these machines included monitors at that price, and home PC buyers not unreasonably expected that a computer system would include a monitor—but by the week before Christmas, with PC prices falling to as low as \$799 and even \$699, you could easily find a very nice machine, complete with monitor, for well under \$1,000.

That wasn't necessarily good news for PC makers and PC resellers, who have long relied on the larger returns from more expensive systems. No one makes much on PCs in this price range—but they're great buys for consumers and ultimately help the whole PC market by bringing in new buyers who simply weren't going to jump when comparable machines cost \$2,000 to \$2,500, not long ago.

Manufacturers and retailers get hit twice here: Not only do these machines have razor-thin margins as a percentage of their selling price, but since the price itself is so much lower, the net proceeds to the maker and seller are far smaller. Would you rather have 12 percent of \$1,800 or 3 percent of \$899? Even with the increased volume, it's gotten a lot harder to make money in the PC business over the past few months.

Then in January, to make things worse, Hewlett-Packard started another round of downward pricing by moving from the “under-\$1,000 PC” to the “under-\$800 PC.” Not some doggy machine, either: HP's lowest-end offering, the Pavilion 3260, has a 200-MHz Pentium MMX processor, 32MB of RAM, a 2.1GB hard disk, a 16-speed CD-ROM drive, and a 56-Kbps modem—all for \$799 (monitor extra). Spend a little more and you could get boxes with 233-MHz Pentiums, or even 266- and 300-MHz Pentium IIs.

I could live with that. You could, too. More to the point, the people in your office could, too.

Which is my point.

Among the odder bits of nonsense floating around the PC business these days is the idea that these new “consumer PCs” somehow represent a separate class of com-

puters: okay for home, for newbies—powerful, neat, pretty cool, standard components, and so forth—but somehow beneath consideration for serious PC users.

Even stranger is the idea that the parallel universe of under-\$1,000 (loosely speaking) business PCs that are emerging now are also somehow flawed boxes—not quite *serious* PCs, not reasonable choices for use in business.

Nonsense in both cases.

I'm not suggesting that you run down to Best Buy and buy a few thousand HP Pavilion 3260s for your Fortune 500 company. You *could*, and they'd work fine, but that's not the point. The point is that the explosion of under-\$1,000 PCs for the home market during the last half of 1997 marked a permanent downward shift in pricing for all PCs. Not every PC is headed for three-figure pricing, but very many are.

Whatever you may think of these \$800 to \$1,000 consumer PCs, if you're involved in choosing PCs for your company, you simply can't ignore the new business PCs in that neighborhood.

HP has been leading the charge on the business-PC side as well as in consumer machines, and its new Brio line of “small-business” PCs comes in at around \$1,000. Compaq's jumping in. Expect to see every other serious player at that price point before long.

Even when it's not immediately obvious. Take Dell, for example. By studiously ignoring the sub-\$1,000 consumer market—presumably because of

margin worries and probably also questions about whether low-end first-time buyers would buy direct—Dell apparently doesn't play in this price range. Wrong. Take a look at Dell's Web site (www.dell.com) where, if you dig a little, you'll find you can buy a Dell OptiPlex GN with a 166-MHz Pentium, 32MB of RAM, and a 2.1GB hard disk (no CD-ROM drive, speakers, or monitor) for just \$955. Want a 200-MHz Pentium MMX CPU? Add \$25. Want built-in 10/100 Ethernet? Add \$75. Either way, you get Dell's top-of-the-line business PC, with DMI 2.0 management features and a great, easy-access chassis.

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JIM SEYMOUR

the rooftops? Can you say "protecting its high-end systems business"?

Initially, the move to sub-\$1,000 PCs was driven by inexpensive non-Intel processors. The \$99 Cyrix MediaGX Processor offered Intel compatibility, high-level integration, and that incredibly low price. It made possible Compaq's Presario 2100, the landmark machine that, almost a year ago, introduced the idea of serious sub-\$1,000 machines. AMD's K6 weighed in next as a higher-performance alternative, and with its adoption by such serious makers as IBM and Compaq, established a second good low-cost CPU choice.

So is this market going to continue to be driven by cheap non-Intel processors? Not if Andy Grove has his way. Changing its strategy of allowing CPU prices to ratchet downward only with the release of faster replacements, Intel is taking aim on the \$1,000-PC market with two new CPUs designed specifically for these machines.

The first, due by early summer, is Covington, a 266-MHz Pentium II intended for sub-\$1,000 PCs. It drops L2 cache and the original Pentium II's plastic housing but brings PII performance to these inexpensive boxes. On its heels we'll see Mendocino, a 300-MHz version with L2 cache on the chip. Intel says Mendocino is for systems selling at a little more than \$1,000, but I believe that when it appears later this year it will quickly become the chip of choice for \$1,000 machines.

The proliferation of these low-cost, high-performance CPUs, and the systems built around them, will consolidate the position of the \$1,000 PC as a serious business machine.

It will also help us focus on asking the right questions, not the wrong ones, when we're buying business machines. *Which processor? How much memory? Which operating system today? And which six months from today?* My advice: Buy nothing lower than a 200-MHz Pentium and 32MB of RAM for an office PC. If you can, make that 64MB of RAM, especially if you share my conviction that you're headed for Windows NT 5.0 this year. And if you can afford to move up in CPUs as well, get a 266-MHz Pentium II.

Yes, the management features built into the new low-cost business PCs make them a better choice for the office than the even cheaper consumer PCs. But don't succumb to these odd ideas about \$1,000-or-so PCs being somehow unworthy of your consideration. They're solid values, harbingers of a new world of lower-cost business computing. **PC**

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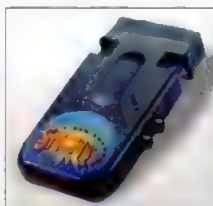
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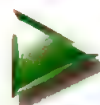
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Things Can Only Get Better

Online stock trading, online financial advice, online banking—even online agents that find you the best deal on your insurance or mortgage. What more could you ask from your financial software? What about getting some of the basics to work better?

Financial software isn't the only software category that needs to remember the adage, "Learn to walk before you run." It's just that this category was uppermost in my mind during the past couple of weeks as I closed the books on our family's finances for the year and started planning for the year ahead.

For over a dozen years I've used Intuit's Quicken, dabbling occasionally in Meca Software's Managing Your Money (too much work, which is why the product never took off) and Microsoft Money (not different or better enough to merit a change). Quicken remains better than Microsoft Money by a slight margin, as we noted in our previous issue ("Money 98 vs. Quicken 98," February 24, 1998).

I'm hooked on personal finance software. This is one category that absolutely saves you time compared with working by hand with a calculator. For the most part, the software gets better, although some year-to-year improvements are dubious. Now that the core technologies work, it's time to make them easier, more helpful, and more automatic.

No matter how much help the software offers—on disk, on the CD, in what little is left of the paper manuals—sometimes the information you want just isn't the information that's available. For instance, my family made some capital improvements to our house and I wanted to know how we should track them. But "capital improvement" isn't a predefined tracking category, nor is the topic covered in the help index. There's nothing—neither an explanation of how and why to track this item nor any information telling you why you can't or shouldn't track it. In general I've found that going from disk-based help to CD-based help doesn't give you any more information; it just gives you the same gruel but with sound and animation. And going online to the World Wide Wait merely wastes 5 minutes of your life dialing up, logging on, and finding that nothing is there, or you can't find it if it is.

Another annoyance is how little we've progressed with respect to online bill paying. In the 1980s, I thought computer-printed checks were going to be a big time-saver (they turned out to be a small time-saver). In the early 1990s, I

thought online bill paying was going to be a big time-saver. It is, but I'm waiting for some serious improvements.

I can't believe how few payees today can actually receive payments electronically, as opposed to you transmitting the payment electronically and waiting for Checkfree to cut a paper check that's delivered a week later. One of Quicken's credit card partners, First Chicago, can send you a daily electronic summary of your credit card charges, but when you pay your bill electronically, it gets paid as a paper check rather than an electronic transfer of funds. I don't see any good reason why Checkfree, the major electronic check-payments service, can't let you pay the end-to-end-electronic bills immediately, meaning overnight.

When I want to update my financial information, it's a labor-intensive process. I can access my MasterCard and Visa statements from the Online Center (separate steps for each card), but only via the Internet; no more direct dial-up this year. To transmit Checkfree payments, which is inexplicably not possible from the Online Center, you can only dial directly; there's no Internet access. Then there's a fourth dial-up call to my bank to get that statement and then about half a dozen further steps to transfer that data to my Quicken register.

The upshot is that I do have a better and more instant picture of how our family is doing financially now than I did a decade ago, but I'm still doing a lot more

manual accounting work than I ever expected.

Ideally I'd like to see *all* my information updated in one fell swoop with just one online connection. I'd like to see bills paid instantly. And I'd like to see more bills paid automatically, meaning the bill should come to me electronically (with a paper backup just in case) and then, unless I stop the process, the bill should be paid without my intervention. Right now that's pretty much limited to utility bills.

Quicken triumphed in the 1980s by understanding that we want to spend less—not more—time working at basic financial tasks. Maybe it's time for a return to that core value. **PC**



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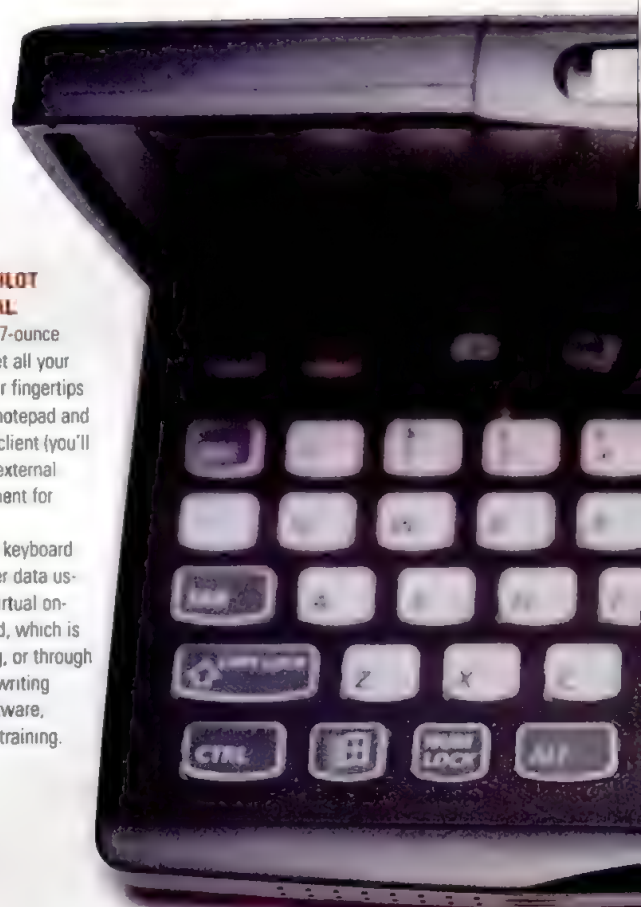
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Actual Size

The Ultimate Personal

By Robert S. Anthony Can today's hand-held PCs and pocket-size gizmos send

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Wouldn't life be grand if every communications and data management tool you ever needed could fit on your wrist or in your pocket?

Although Dick Tracy-style TV communicator watches are not quite here, many recent advances have been made in the hand-held computing market. It's no longer strange to spot someone reading e-mail on a digital cellular phone or transmitting messages with a two-way pager.

Hand-held computing is hardly a new concept. Long before the operating system Windows CE was a glint in Microsoft's corporate eye, Apple Computer, Hewlett-Packard, Psion, Sharp Electronics, Texas Instruments, and many others offered small devices that provided some degree of connectivity to e-mail or desktop PCs. These devices ranged from several ounces to 3 or 4 pounds, and they typically ran proprietary operating systems or DOS.

Although hand-held PCs (HPCs) have



HP 620LX PALMTOP PC.

PRO: Windows CE 2.0 devices offer support for color, and porting applications is made easier given the OS's shared elements with Windows 95. Also, a built-in keyboard makes data entry much more convenient.

CON: These devices are larger and bulkier than PalmPilot-class units, and battery life for color devices is a quarter to a half that of monochrome units. Though the built-in keyboard is better than a stylus for data input, the tight spacing between keys (compared with desktop keyboards) makes it uncomfortable for anything but short memos or e-mail.

Peripheral

your notebook into an early retirement?

been around for a long time, this category didn't find broad appeal until fairly recently. Significant attention came to the class in 1996 with Microsoft's introduction of Windows CE for HPCs. The OS was a response to common weaknesses in previous HPCs, such as the lack of applications and a babble of proprietary operating systems.

Windows CE shares the look and feel and some programming elements of Windows 95, but the two are not identical. Applications must be rewritten for Windows CE. But at least theoretically,

because of the shared elements, Windows CE eases the porting task. Unfortunately, Windows CE 1.0 became more notable for its limitations than for its features: It lacked color support and a spell-checker, and printing was often nearly impossible.

As users waited for an improved Windows CE, the pocket-size 3Com PalmPilot, with its proprietary OS, caused a sensation in the hand-held market when it was launched in January of 1996. The



FRANKLIN REX-3-DS PC COMPANION.

PRO: All your PIM data fits in a compact and ultra-portable device. This unit is no bigger than a business card holder, weighs just 1.4 ounces, and runs for months.

CON: This is a read-only device: You can't enter any new data into the Rex-3-DS, nor does it yet have the broad application support that PalmPilot, Psion, and Windows CE devices have.

Editors' Choice

- Franklin Rex-3-DS PC Companion
- Psion Series 5 Handheld Computer
- 3Com PalmPilot Professional



Our three Editors' Choice winners run the gamut of the hand-held market and range from the tiny read-only

Franklin Rex-3-DS PC Companion (\$180 street) to the stylus-based 3Com PalmPilot Professional (\$370 street) to the full-featured Psion Series 5 Handheld Computer (\$600 street) with a built-in keyboard.

The Rex-3-DS offers super portability and minimum bulk. The unit lets you store and view PIM information (up to 3,000 contacts, tasks, or appointments), all in a Type II PC Card. The Rex-3-DS is a read-only device; you input new data to your PC and then update the unit. Synchronization is painless: Use either a serial connection or a PC Card slot.

If you want a device you can occasionally input new data into but still don't want much bulk, then the PalmPilot is for

you. Just 5.7 ounces, the PalmPilot fits neatly into a suit pocket. The device offers you a notepad as well as access to your PIM data and e-mail (with the optional modem). Use either the virtual keyboard or the Pilot's Graffiti handwriting recognition software to enter new data. Synchronization back to your PC is painless with the supplied cradle and software; you can also synch up through the optional modem or LAN kit. The wide range of third-party applications and accessories available are also a boon.

The monochrome Series 5 is for those who can't do without a built-in keyboard but don't need the functionality or weight of a notebook PC. The unit runs on Psion's own EPOC32 OS, but using or transferring Windows files is not a problem. Spreadsheet, word processor, and database applications are built-in, just as with Windows CE devices, and you also get a built-in voice recorder. Windows CE 2.0 devices show a lot of promise, but for now none that we tested surpass the Series 5's balance of features, price, and battery life.

The Apple MessagePad 2100 (\$1,150 street) earns an honorable mention. This monochrome stylus-based unit is larger than most of the tested devices, but it has truly usable handwriting recognition software as well as the best backlight we saw. An external keyboard is optional. The unit is compatible with both Mac and Windows, and a host of third party software is available.

PalmPilot's utter simplicity and fast data synchronization features helped it gain a huge market share and brought awareness of HPCs to a wider audience.

Windows CE 2.0, which finally shipped in October of 1997, offers a number of enhancements. The vastly improved Web browser and support for color and 16-gray-scale displays, TrueType fonts, Ethernet connectivity, and e-mail attachments have led to a new class of more robust Windows CE hand-held PCs. The OS is also gathering ISV support.

Despite these improvements, Windows CE 2.0 faces serious challenges: It has to contend with popular rivals such as the PalmPilot, which has loads of ISV support, and it has to compete with devices such as electronic organizers with augmented features, which cost a third or half as much as some Windows CE units. In addition, Psion's robust EPOC32 operating system (used by the Geofox and Psion devices we review), many years old and designed from the ground up for HPCs, also has features and third-party applications that rival those found in Windows CE 2.0.

REVIEW CRITERIA

For this roundup, we looked at devices that provide PIM and scheduling functions and then offer significant additional features. The sin-

gle exception was the Franklin Rex-3-DS PC Companion, a read-only PC Card-size organizer that is in a category by itself.

Our filter netted us four keyboard-input HPCs: The Geofox-One Professional and the Psion Series 5 Handheld Computer both run Psion's EPOC32 OS, whereas the Casio Casiopeia A-20 and the color HP 620LX Palmtop PC run Windows CE 2.0. We review two pocket-size pen-based devices: the Texas Instruments Avigo 10 and the 3Com PalmPilot Professional. We also looked at the Apple MessagePad 2100, a larger pen-based unit.

The three remaining devices look like cellular phones, but all provide some form of Internet connectivity and store PIM data. The Nokia 9000i Communicator stores data locally and opens to reveal an LCD screen and a QWERTY-style keyboard, whereas the two dual-mode cellular phones from Mitsubishi and Sam-

sung work with the AT&T PocketNet Service to provide access to data stored in a secured server (as discussed in our PocketNet review).

Although many Windows CE 2.0 HPCs were announced in late 1997, not all were available as production-level units in time for this roundup. The units we review are representative of this type of system, but for a broader view, we also cover

SUITABILITY TO TASK

Note that not all of the units in this roundup will have full Suitability to Task ratings. (N/A means "Not applicable: The product does not have this feature.") For the units that can be judged by these categories, our ratings are as follows:

General use covers ease of use in performing such tasks as file management, note-taking, updating contact lists and address books, creating To Do lists, and taking notes on a memo pad.

Field/mobile use reflects the unit's battery life, weight, dimensions, and rugged design. Systems rated *excellent* also offer mobile communications.

Systems rated *excellent* in **handwriting recognition** have no-training and training scenarios, as well as great accuracy.

Communications reflects the unit's capability to synchronize data with a desktop. Its communications via a modem or IR port were also tested. A system rated *excellent* will also have fax, cellular, and e-mail capabilities.

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Don't miss ZDNet's *PalmPilotUser* (www.palmpilotuser.com) for the latest pilot news and software.

four forthcoming units in the sidebar "Near-Final Windows CE 2.0 Services." Other Windows CE 2.0 units not available for this roundup include the Compaq C-Series PC Companions, the monochrome HP360LX, the Hitachi Hand-held PC, the LG Phenom Plus, and the Novatel C-O-N-T-A-C-T.

THE NEXT LEVEL

The HPC category continues to broaden, thanks mostly to Windows CE. The OS will soon appear in unexpected places—such as in your car. Microsoft's Auto PC's (A/PCs) will combine your car stereo with a Windows CE computer. In addition to a touch screen and standard audio functions, A/PCs will respond to speech commands and support GPS devices for navigation and route-mapping functions. Intel is working on a similar concept, the Connected Car, which will be OS-independent.

Microsoft's Jupiter project will bring the Windows CE OS to a larger computer format, similar in size to Toshiba America's Libretto series of mininotebooks. These units will offer larger displays and more user-friendly keyboards than HPCs. Finally, Microsoft's Palm PCs (P/PCs) will port Windows CE to pen-based organizers with size and functionality similar to the PalmPilot. Some P/PCs, from companies such as Casio, Everex, Philips, and others, will be announced by the time you read this. A/PCs and Jupiter products probably won't be available commercially until mid or late 1998. (For more information, see Trends in this issue.)

WHAT DO YOU NEED?

HPC vendors will readily admit that their devices are not meant as full-time notebook replacements. The target user is someone who needs quick access to PIM data, reasonable access to e-mail, and the ability to view and edit small files.

The Rex-3-DS does an admirable job of keeping itself out of your way while still keeping PIM data handy, but it is a read-only device. The Avigo and the PalmPilot offer quick synchronization with desktop data, but we find pen-based input is best for those intending to do minimal data entry.

The Apple device, the Psion, and the Windows CE units offer a wider range of features on top of PIM and scheduling functions, which include scaled-down versions of familiar word processing and spreadsheet applications, but in a larger, heavier format. The enhanced phones we review provide a solution for those needing 24-hour access to personal, corporate, or financial data—if they're within the range of a supporting cellular and digital network.

In the end, you may decide to buy more than one of these devices, since none of them cover all of the bases. The only limit is the thickness of your wallet.

Our Contributors: ROBERT S. ANTHONY is a senior writer at *PC Magazine*. BRUCE BROWN is a contributing editor, and CADE METZ is a senior staff writer for *PC Magazine*. RICH FISCO was the project leader, and ANUSH YEGYAZARIAN was the associate editor in charge of this story.

Apple MessagePad 2100

At 22.4 ounces, the Apple MessagePad 2100 is the heaviest unit we reviewed. The \$1,150 street price also makes it the most expensive unit of our tested configuration (the base unit is \$1,000), and at 1.1 by 4.7 by 8.3 inches, it is one of the largest. The unit is, in several aspects, the slickest and most cleverly designed HPC of the bunch, however. (No surprise for some, since Apple has been in this market since its inception.) The MessagePad's connectivity, expandability, and abundance of useful built-in applications make it a good choice, particularly for those working in mixed computer environments: The unit is compatible with Windows 3.1, 95, and NT, and with Apple Macintosh.

SUITABILITY TO TASK	
Apple MessagePad 2100	
General use	Good
Field/mobile use	Good
Handwriting recognition	Excellent
Communications	Fair

The MessagePad runs the Newton 2.1 OS. Standard applications, including a word processor and spreadsheet, calculators and conversion formulas, PIM, and connectivity software are stored in the 8MB ROM, and user applications

and data can be saved in the standard 4MB DRAM, in the 4MB flash RAM, or on optional 2MB or 4MB flash storage PC Cards. The two Type II PC Card slots can also accept modems or pre-programmed cards with customized applications. A lot of third-party software is also available for the unit.

A removable lid protects a generous 16-shade 4.9- by 3.3-inch display, which lights up brightly when the backlight is on. The screen can work in either portrait or landscape mode and accepts input from an on-screen keyboard via a trainable handwriting recognition engine or an optional \$80 external keyboard (price included above). The unit's four double-A alkaline batteries should run for six weeks of normal use or up to 24 hours of continuous use.

The system's handwriting recognition software worked well and is easy to use and simple to adjust for cursive or printed text. As a matter of fact, this is the only unit to allow cursive text input, and it even lets you select the spacing between letters. The sound played back by the built-in voice recorder is somewhat scratchy, though.—Bruce Brown

Apple MessagePad 2100. Street price: \$1,150. Apple Computer Inc., Cupertino, CA; 800-538-9696, 408-996-1010;

www.newton.apple.com.
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► The Apple MessagePad 2100 has a great, bright display and excellent handwriting recognition software.





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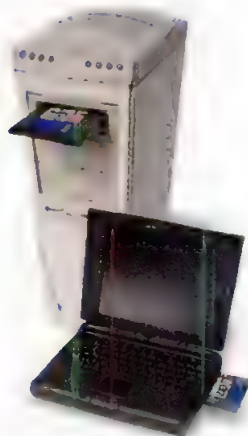


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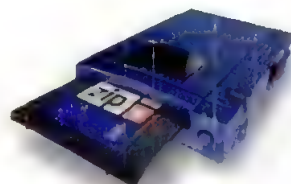
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AT&T PocketNet Service

If your area is covered, AT&T PocketNet Service offers you a convenient service that is bound to improve and proliferate. PocketNet works with dual-mode analog cellular voice and CDPD data phones, which can be used to access e-mail alerts and the e-mail forwarded to PocketNet, PIM data stored on a private section of AT&T's Web site (no data is stored locally), and surprisingly data-rich information sites. Security includes password protection for the Web site and e-mail, and authentication codes for voice data; other data is sent with authentication and encryption.

Subscribers choose one of two similar 9.6-ounce phones, from either Mitsubishi or Samsung (\$300 street). PocketNet Service costs \$29.99 per month for unlimited data access (cellular phone service must be contracted separately, and can be quite costly).

On your private Web site, you can create and store up to 5,000 contacts, viewable and editable from the phone or desktop; you can also synchronize contacts and schedules from major PIMs via Puma Technology's IntelliSync for AT&T PocketNet (\$69.99 list). The e-mail and other messages you receive can also be forwarded to a fax machine for hard copy. The Web sites accessible through PocketNet use a special format to allow you to view them. When you have a good digital connection, the sites offer quick access to sports, news, financial, travel, and entertainment data. Check with AT&T for a complete list of accessible sites. Seventy U.S. metropolitan markets are covered (exceptions are Atlanta, Kansas City, Los Angeles, and New Orleans).

Although the phone can also function as a pager, but delays caused by Internet traffic could make it unfeasible for transmitting truly urgent messages. Navigating the PocketNet menus with the phone's buttons and entering data via the keypad were both reasonably easy, though not suitable for significant amounts of data entry.—BB

AT&T PocketNet Service. Street price: Telephone, \$300; service, \$29.99 per month. AT&T Wireless Services, Kirkland, WA; 888-328-2288, 425-803-4000; www.att.com/pocketnet/. Choose 571 at www.pcmag.com/infolink.

Casio Cassiopeia A-20

A marked improvement over Casio's original line of Windows CE 1.0-based Cassiopeias, the Casio Cassiopeia A-20 (\$600 street) is a perfectly adequate Windows CE 2.0 HPC. Although it comes with a large and useful software bundle, the unit's features do not match up well against the more robustly equipped competition.

The 15.2-ounce Cassiopeia's 8MB of RAM and 8MB of ROM (both at system maximum) and the size of its screen (6.2 inches wide, 640-by-240) compare well with most Windows CE 2.0 HPCs. But the 4-gray-scale, passive-matrix display pales in comparison to the 16-gray-scale and 256-color displays on other Windows CE 2.0 units we saw. The unit does have a backlight, though.

The Cassiopeia's keyboard offers fairly responsive rectangular "Chiclet"-style keys with a 12-mm key pitch, and its embedded function keys are labeled with blue icons. The system comes with a serial cable to connect with a desktop PC. The serial port is protected by a slide-away door.

A Casio Bonus CD includes Symantec's Norton pcAnywhere (CE remote-control software), bFAX Professional (fax software), LandWare Virtual Courier Lite for Desktop cc:Mail and Microsoft Mail/

Exchange, and a handful of other titles. The CD also includes a software patch to correct a minor problem with the unit's backlight switch. Additional software is available to registered owners at the company's Web site.

The Cassiopeia lacks a built-in modem but includes a standard Type II PC Card slot and a Compact Flash card slot. Near the rear IR port is a tiny jack for connecting to Casio QV-series digital cameras (\$300 to \$700 street). Also integrated on the unit is a digital audio recorder.

Casio claims 25 hours of use with two standard double-A alkaline batteries. The unit ships with an AC adapter and a lithium ion battery pack.—Robert S. Anthony

Casio Cassiopeia A-20. Street price: \$600. Casio Inc., Dover, NJ; 888-204-7765, 973-361-5400; www.casiohpc.com. Choose 572 at www.pcmag.com/infolink.

SUITABILITY TO TASK			
AT&T PocketNet Service		Casio Cassiopeia A-20	
General use	Poor	General use	Fair
Field/mobile use	Good	Field/mobile use	Fair
Handwriting recognition	N/A	Handwriting recognition	N/A
Communications	Fair	Communications	Fair

◀ AT&T PocketNet Service can be convenient if you live and work within a covered area.

▶ The Cassiopeia's 4-gray-scale display is lacking compared with the 16-gray-scale and color displays found on its competitors.



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Near-Final Windows CE 2.0 Devices

By Robert S. Anthony

The Fall Comdex '97 show in Las Vegas was teeming with announced Windows CE 2.0 hand-held PCs, but many were not in final production in time for this roundup. But we did acquire a few almost-ready HPCs, most of which will be ready for sale by the time you read this.

NEC MOBILEPRO 700 SERIES

NEC Computer Systems Division opens a new class of larger, more finger-friendly Windows CE 2.0 HPCs with its **NEC MobilePro 700** series. The near-ready, 24-ounce, four-gray-scale monochrome MobilePro 700 (\$699 direct) and the early prototype of the 28.8-ounce MobilePro 750C, a color unit, feature backlit 7-inch-diagonal, 640-by-240 displays that are significantly larger and more readable than the 6.5-inch displays on most Windows CE 2.0 HPCs. Each unit has programmable function keys and comes with a stylus.

The 9.6-inch width of each unit allows for a responsive keyboard with 12 separate function keys and a 16.5-mm key pitch. By contrast, a standard desktop keyboard has a 19-mm key pitch. The Windows 95-based Toshiba Libretto 70CT mininotebook has a 15-mm key pitch. Windows CE devices have a 14-mm key pitch, on the average.

Each unit comes with 8MB of RAM, a 33.6-Kbps low-power hardware fax modem with a phone jack, and a digital audio recorder. With Microsoft Pocket PowerPoint and other applications that support the built-in VGA port, you can send color graphics to an external monitor.

NEC claims that two double-A batteries will last 30 hours in the MobilePro 700. The MobilePro 750C, expected to sell for less than \$1,000, comes with a lithium ion battery pack; battery life should be 10 to 12 hours. The color unit is not expected to ship until mid-1998. (NEC Computer Systems Division of Packard Bell NEC, Boxborough, MA; 888-863-2669, www.necnow.com. Choose 576 at www.pcmag.com/infolink.)

PHILIPS VELO 500

Philips Mobile Computing Group offers the **Philips Velo 500**, a revision of its Windows CE 1.0 unit the Velo 1. The Velo 500 (\$640 street with 16MB of RAM) comes with a larger, backlit 640-by-240, 16-gray-scale monochrome display. The Velo 500

maintains the Velo 1's shape and built-in software modem but speeds the modem up from 19.2 Kbps to 28.8 Kbps and moves the flip-open jack to the back of the display panel. Also included is a digital audio recorder.

The Velo 500 has 61 small but responsive oval-shape keys, with a 12-mm key pitch. The 15.3-ounce unit has two Miniature Card slots for ROM or RAM upgrades and comes with a docking station with a serial cable for desktop PC connectivity.

Like most Windows CE units, it offers quick-launch application buttons and a stylus.

Philips claims 12 to 15 hours of battery life with the standard nickel hydride battery pack. The Velo can also use two alkaline double-A batteries and has a backup lithium ion battery. The unit lacks a PC Card slot, but Philips offers a \$100 PC

Card module. (Philips Mobile Computing Group, Sunnyvale, CA; 888-367-8356; www.velo.philips.com. Choose 578 at www.pcmag.com/infolink.)

SHARP MOBILON

Sharp Electronics Corp. offers the Mobilon line of hand-held PCs, which top out with the 256-color **Sharp Mobilon HC-4500C** (\$1,000 street with 16MB of RAM). We saw a late beta version of this product. Sharp also offers two 16-gray-scale monochrome Windows CE 2.0 Mobilons: the \$600 **HC-4000** (4MB of RAM) and the \$700 **HC-4100** (12MB of).

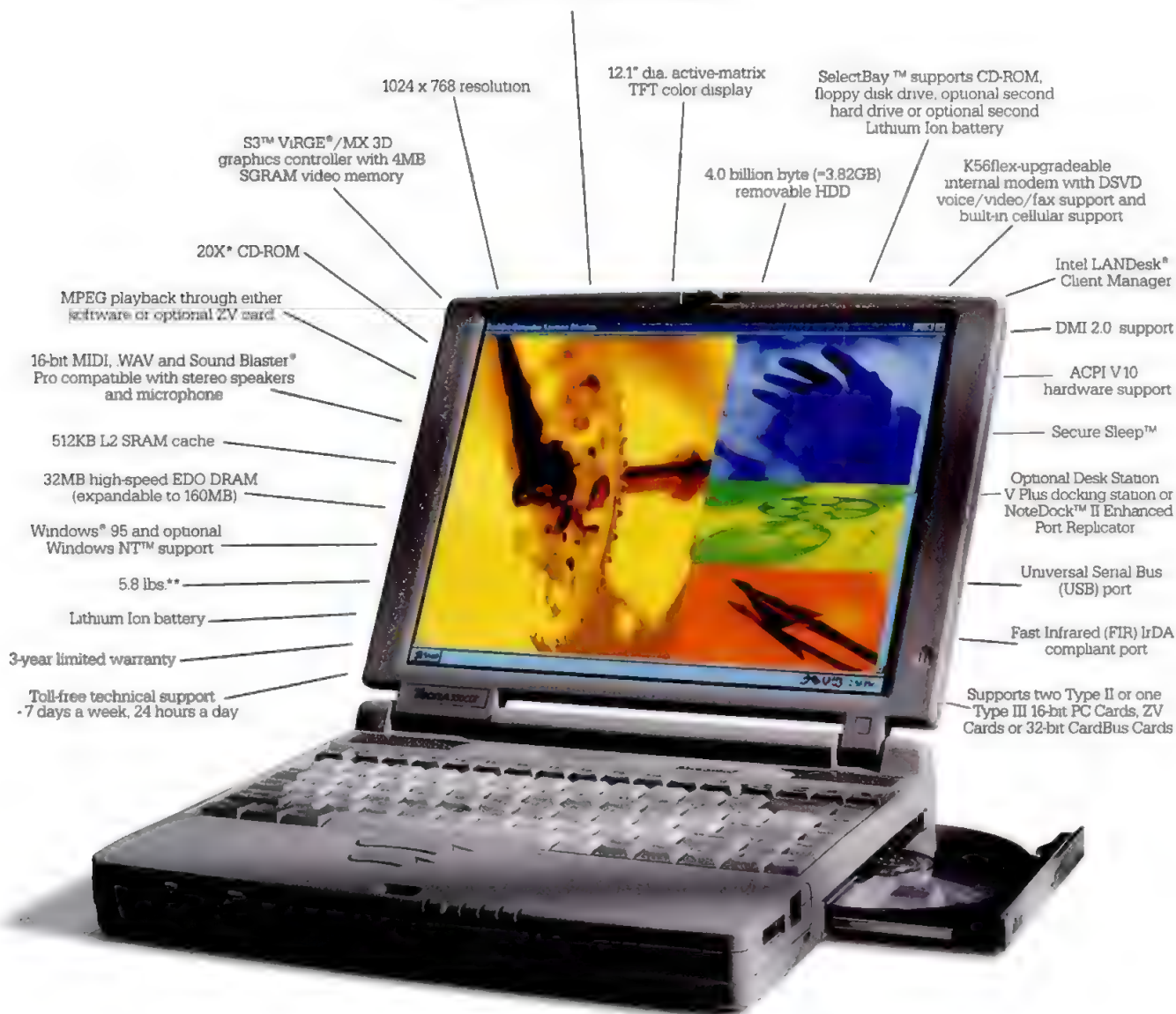
Each Mobilon comes with a built-in 33.6-Kbps fax modem with a pop-open phone jack, and a Type II PC Card slot. The HC-4500 comes with a lithium ion battery pack, and the monochrome units come standard with double-A batteries. The monochrome units have a claimed battery life of 25 hours.

The HC-4500's keyboard offers ample feedback and has seven separate function keys for quick access to major applications. Our unit also came with the Sharp CE-AG04 Color Digital Camera Card (\$400), which slides into a Type II PC Card slot and turns the Mobilon device into a complete photo-editing system, with the aid of the included editing software. The camera supports 16.7 million colors at a 640-by-480 image resolution. (Sharp Electronics Corp., Mahwah, NJ; 800-237-4277; www.sharp-usa.com. Choose 580 at www.pcmag.com/infolink.)



Clockwise from top: The NEC MobilePro 750C, Sharp Mobilon HC-4500C, Philips Velo 500, and NEC MobilePro 700.

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Franklin Rex-3-DS PC Companion



One of our Editors' Choice winners, the Franklin Rex-3-DS PC Companion (\$180 street) is the least expensive and most portable PDA in this roundup. By design it's also the most limited in functionality: The Rex-3-DS, a PC Card, is a lookup-only device for contacts, tasks, appointments, and short memos. Unlike with the PalmPilot, you cannot enter new information into the Rex-3-DS itself. The unit is right for mobile professionals who don't want to carry a PalmPilot or care about the Rex-3-DS's inability to accept new data without synchronizing with a host PC. The unit's portability—it fits in your wallet—and ease of use can't be beat.

Powered by two lithium watch batteries rated for six months' use, the Rex-3-DS can store up to 3,000 contacts, tasks, or appointments. The 1.4-ounce device is a Type II PC Card with a 1.3- by 2.1-inch, non-backlit, monochrome, high-contrast LCD screen that displays approximately nine lines of 32 characters each. Five flush-mounted navigation buttons are spaced far enough apart for use with gloves on. For users without a computer equipped with a PC Card slot, a small docking station plugs into a serial port. A small leather wallet with a tiny notepad is also included. A 750-item-model Rex-1 sells for \$130 without the card dock.

Starfish Software's Rex Information Manager, included with the Rex-3-DS, is a powerful PIM and synchronization program that can import files from other major PIMs and contact managers such as ACT! 3.06, Lotus Organizer 97, Microsoft Outlook 97, Schedule+ 7.0, and Sidekick 98. After the files are imported, synching with the Rex-3-DS takes just seconds, even with a test file of almost 2,000 contacts. Starfish Software will offer a \$50 utility for direct synchronization with Microsoft Outlook 97 and Schedule+ 7.0, probably by the time you read this.—BB

Franklin Rex-3-DS PC Companion. Street price: \$180. Franklin Electronic Publishers, Burlington, NJ; 888-739-6400, 609-386-2500; www.franklin.com/rex. Choose 573 at www.pcmag.com/infolink.

Geofox-One Professional

The Geofox-One Professional (\$799 direct) uses Psion's operating system EPOC32 and includes all the programs and functionality of the Psion Series 5, including voice recording, database capabilities, and word processing, and adds a standard 33.6-Kbps PC Card modem. Pleasant to use, with a larger-than-usual screen for an HPC, the Geofox-One is bested only in terms of size by its more compact competitors.

The unit weighs only 13.7 ounces and is just 0.8 inches thick and 7.4 inches wide, but its 4.7-inch depth makes it too big to fit in a jacket pocket or even to carry conveniently in many handbags. The unit does come with an AC power adapter equipped with plugs for Europe, the United Kingdom, and the United States, however. A Type II PC Card slot holds the modem and can also accept removable memory cards. Battery life is 25 hours without the modem or backlighting.

The greatest difference between the Geofox-One and most PDAs and HPCs is its screen size. The 6.8-inch-diagonal, 640-by-320 monochrome LCD has minimal backlighting that does not do much good in

dim light, but its greater-than-average size and 16-shade gray scale help visibility significantly. The keys have a spacing of just over 14 mm and, with a separate numeric keypad, make writing notes and answering e-mail fairly easy.

Word and Excel files can be converted smoothly via the file-transfer program and the Geofox-One can also run third-party applications written for the Psion Series 5. Instead of a touch screen, the Geofox-One uses an integrated GlidePoint touch pad for navigation. Users accustomed to notebook PCs may feel at home with the touch pad, but in the world of HPCs, touch screens tend to be faster.—BB

Geofox-One Professional. Direct price: \$799. Geofox Inc., Austin, TX; 888-443-6369, 512-451-5055; www.geofox.com. Choose 574 at www.pcmag.com/infolink.

SUITABILITY TO TASK			
Franklin Rex-3-DS PC Companion		Geofox-One Professional	
General use	Poor	General use	Fair
Field/mobile use	Good	Field/mobile use	Good
Handwriting recognition	N/A	Handwriting recognition	N/A
Communications	N/A	Communications	Good

◀ The Rex-3-DS's unique PC Card form makes it very convenient; the navigation buttons are well spaced.

▶ The Geofox-One's backlight could be better, but its large, 16-gray-scale display helps clarity.



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CAN WE BUILD ONE FOR YOU?

HP 620LX Palmtop PC

Hewlett-Packard, the first to market with a wide-screen Windows CE HPC, in the form of last year's monochrome HP 320LX, is the first to push the envelope again, with its color HP 620LX Palmtop PC (\$900 street). The 620LX comes with 16MB of RAM, which goes up to 26MB maximum. The unit's clear, 256-color, 640-by-240 display and its many quick-launch buttons set it in a class above most Windows CE 2.0 HPCs.

At 20.6 ounces including its lithium ion battery pack, the black 620LX is slightly heavier than most HPCs but is not much thicker or wider. To the right of the backlit 6.5-inch display is a narrow "hard icon panel" with four buttons for quick access to brightness, contrast, and audio, and e-mail, fax, and file-locator functions. Eight hard icons on a "quick launch pad" above the keyboard offer access to standard Windows CE applications such as Pocket Excel and Pocket Word. The 620LX also comes with a full version of Bsquare bFAX Pro 3.01, HP's Month-at-a-Glance-Plus, which adds new views to the standard Windows CE 2.0 calendar application, and On The Go Software's Pocket Quicken ExpensAble, which tracks business expenses and can export the data to Intuit's Quicken.

The unit's keys are angled up slightly from front to back and are reasonably set for touch-typing. Data can be synchronized with a desktop PC via an included serial cable, which can connect directly to the HPC or to the unit's bundled quick-connect docking cradle. With the unit's included software, data can also be imported from older HP handheld products.

HP claims 5.5 hours of battery life with the standard battery pack (most monochrome Windows CE devices average over 20 hours); this goes up to 11 hours with an optional lithium ion battery pack (\$120 street). The unit also comes with a CD-ROM-based guide. —RSA

HP 620LX Palmtop PC. Street price: \$900. Hewlett Packard Co., Palo Alto, CA; 800-443-1254, 408-246-4300; www.hp.com/handheld. Choose 575 at www.pcmag.com/infolink.

Nokia 9000i Communicator

Combining a hand-held computer, a digital cellular phone, and fax capabilities, the Nokia 9000i Communicator is a versatile multipurpose device. Sold by various digital telephone providers, the 9000i's street price ranges from \$850 to \$1,000, plus monthly charges for telephone, fax, and data service. If you're in an area with GSM coverage in the U.S., the 9000i's compelling range of features make it especially useful as a self-contained organizer and multifaceted communications device.

With the case closed, the 14-ounce 9000i looks like a fat cellular phone at 1.5 by 6.5 by 2.5 inches, but opening the cover reveals a 1.4 by 4.5-inch LCD screen and a full but tiny QWERTY keyboard with numerous navigation and selection keys and on-screen menu items. Typing on the tiny keyboard is somewhat more difficult than on the other HPCs. Keys switch between major functions,

including telephone, fax, SMS (short message/pager service for 160-character messages), the Internet, contacts, notes, and calendar—all easy to use—plus a variety of applets including a calculator, clock, and conversion calculator.

The 9000i runs on the GeoWorks OS and has an Intel 386/24 CPU and 8MB of memory, with 2MB of that for user documents. In addition to being a digital telephone, if you contract for all services, the unit can send and receive text-based faxes and can access the Internet, including the Web. No special programming is required by Web site creators, though the 9000i's limited graphics support on its ten-line nonbacklit monochrome screen makes some pages difficult or impossible to read. To back up or synchronize data (via Puma Technology's Intelli-Sync, optional), you can communicate with a conventional PC through an IR port or an optional serial cable connection. —BB

Nokia 9000i Communicator. Street price: \$850 to \$1,000 (depending on provider); Nokia Inc., Dallas; 800-665-4228, 972-257-9800; www.nokia.com. Choose 577 at www.pcmag.com/infolink.

SUITABILITY TO TASK			
HP 620LX Palmtop PC		Nokia 9000i Communicator	
General use	Good	General use	Good
Field/mobile use	Fair	Field/mobile use	Good
Handwriting recognition	N/A	Handwriting recognition	N/A
Communications	Fair	Communications	Good



◀ The HP 620LX Palmtop PC has a great, clear 256-color display, but its battery life needs improvement.

▶ The dual functionality of the Nokia 9000i Communicator is appealing, but its keyboard was more difficult to type on than most.

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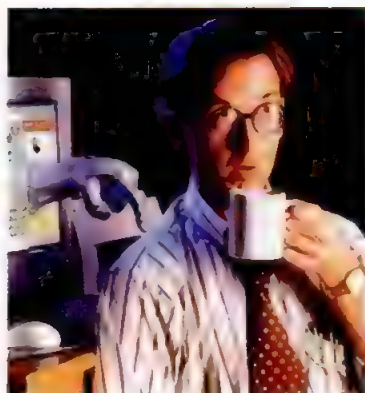
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References and Additional Information

1. Hundreds of thousands of satisfied Quantex customers
2. Quantex Business Consultants at (800) 346-6572
3. The Quantex web site at www.quantex.com



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Compaq	
Gateway 2000	Good
Micron	
Acer	Fair
Toshiba	
Digital	Poor
Packard Bell	

Windows Magazine, 8/97



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- 32X Max EIDE CD-ROM Drive
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QP5/233 SB-1 (with MMX™ Technology)...\$1199

QP6/233 SB-2 **\$1699**

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- 32X Max EIDE CD-ROM Drive
- Quantex Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 95 with MS Plus
- MS Office 97 Small Business Edition
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- 17" Digital Monitor (15.8" viewable)
- Choice of Intel PRO 100 PCI Ethernet Adapter with Wake-On-LAN Technology or K56flex protocol Fax/Modem*
- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
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QP6/300 SB-3 (w/ Pentium® II Processor)...\$2149

QP6/333 SB-3 (w/ Pentium® II Processor)...\$2349

QP6/333 SB-4 **\$2599**

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- 64MB SDRAM Memory / 512KB Secondary Cache
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- 3D Labs Permedia 2 AGP Graphics Card with 8MB
- 19" Digital Monitor (18.1" viewable)
- 32X Max EIDE CD-ROM Drive
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows NT 4.0 Workstation
- MS Office 97 Small Business Edition
- 3-year limited warranty with 1-year On-Site Service**
- 24-hr./7-day Technical Support
- Q5entry Technology (including Intel LANDesk Client Manager V 3.11)
- Upgrade to Intel PRO 100 PCI Ethernet w/WOL* for \$69
- Upgrade to K56flex protocol Fax/Modem* for \$69

QP6/266 SB-4 (w/ Pentium® II Processor)...\$2249

QP6/300 SB-4 (w/ Pentium® II Processor)...\$2399

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- 20X Modular CD-ROM Drive
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- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- USB and Fast IR Ports
- Integrated Personal Touchpad
- MS Windows 95
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- 1-year parts and labor limited warranty on all other components
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- Add a PCMCIA NIC for only \$129
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- Add a 2nd Lithium Ion Battery for only \$169

H-1210 w/166MHz Pentium® processor
w/MMX™ Technology...\$2199

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- 512KB Pipelined Burst Cache
- 4GB HD / 3.5" 1.44MB Modular Floppy Drive
- PCMCIA K56flex protocol Fax/Modem*
- 24X Modular CD-ROM Drive
- PCI Bus with 128-bit graphics accelerator
- Integrated 16-bit Stereo Sound and Speakers
- Smart Lithium Ion Battery
- 2nd Lithium Ion Battery
- Mini-Docking Station
- USB and Fast IR Ports
- Integrated Personal Touchpad
- Windows NT Workstation 4.0 or MS Windows 95
- MS Office 97 Small Business Edition
- Carrying Case
- 24-hr./7-day Technical Support
- 3-year limited warranty on CPU and Main Memory
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QP6/300 SM-4x **\$2499**

(featuring Pentium® II processor)

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- 64MB SDRAM Memory / 512KB Secondary Cache
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- Ensoniq 32-Bit Wavetable Sound Card
- Altec-Lansing ACS-90 Speakers with ACS-250 subwoofer
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- 19" Digital Monitor (18.1" viewable)
- K56flex protocol Fax/Modem* w/Voice Mail and Speakerphone
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- Ensoniq 32-Bit Wavetable Sound Card
- Altec-Lansing ACS-490 Speakers with subwoofer
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows 95 with MS Plus
- Power Multimedia Software Bundle
- Microsoft Office 97 Small Business Edition
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QP6/300 SM-4x SE (w/ Pentium® II Processor)...\$2649

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SUMMARY OF FEATURES

Hand-Held PCs

Reviewed units

Sidebar units*

■ YES ■ NO

Products listed in reviewer order by category

	Apple MessagePad 2100	AT&T PocketNet Service	Casio Cassiopeia A-20	Franklin Rex-3-DS PC Companion	Geofox-One Professional	HP 620LX Palmtop PC	Nokia 9800 Communicator	Psion Series 5 Handheld Computer
Price of tested configuration	\$1,150 street	Telephone, \$300 street; data access service, \$29.99 per month	\$600 street	\$180 street	\$799 direct	\$900 street	\$900 street	\$600 street
Processor type/speed	StrongARM SA-110 / 162 MHz	N/A	Hitachi SH3 / 80 MHz	8-bit RISC / 4.3 MHz	ARM-7 CL-PS7110 / 18.4 MHz	Hitachi SH3 / 75 MHz	Intel 386 / 24 MHz	ARM 7100 / 18 MHz
Operating system	Newton 2.1	N/A	Windows CE 2.0	Proprietary	EPOC32	Windows CE 2.0	Geoworks Geos 3.0	EPOC32
Dimensions (HWD, in inches)	1.1x4.7x0.3	1.2x2.2x0.1	1.0x7.3x3.7	0.3x3.6x2.1	0.8x7.4x4.7	1.4x7.8x4.1	1.5x6.5x2.5	0.9x6.7x3.5
Weight with batteries	22.4 oz.	9.6 oz.	15.2 oz.	1.4 oz.	13.7 oz.	20.6 oz.	14.0 oz.	12.5 oz.
Spacing on built-in QWERTY keyboard	N/A	N/A	12.0 mm	N/A	14.0 mm	13.0 mm	13.8 mm	14.3 mm
Speaker/Microphone/Digital audio recorder	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Memory								
Installed/maximum RAM	8MB / 8MB	N/A	8MB / 8MB	288K / 288K	16MB / 16MB	16MB / 26MB	8MB / 8MB	8MB / 30MB
Installed/maximum ROM	8MB / 8MB	N/A	8MB / 8MB	128K / 128K	8MB / 8MB	10MB / 10MB	N/A	6MB / 6MB
Display								
Resolution	480 x 320 pixels	4 lines x 12 characters	640 x 240 pixels	160 x 96 pixels	640 x 320 pixels	640 x 240 pixels	640 x 200 pixels	640 x 240 pixels
Dimensions (HW, in inches)	4.9 x 3.3	0.9 x 1.6	2.5 x 6.2	1.3 x 2.1	3.2 x 6.1	2.5 x 6.5	4.5 x 1.4	2.0 x 5.3
Number of colors or shades of gray	16 shades of gray	1 shade of gray	4 shades of gray	2 shades of gray	16 shades of gray	256 colors	8 shades of gray	16 shades of gray
Backlight	■	■	■	■	■	■	■	■
Input/Output								
Serial interface/VGA out/Compact card slot	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Built-in PC Card slots	Two Type II	None	One Type II	None	One Type II	One Type II	None	None
Communication								
Built-in software or hardware modem	None	Hardware	None	None	None	None	Software	None
Built-in modem speed in Kbps (data/fax)	N/A	19.2/19.2	N/A	N/A	33.6/14.4	N/A	9.6/9.6	N/A
IrDA port	■	■	■	■	■	■	■	■
Power								
Batteries	Four AA alkaline batteries	Nickel hydride rechargeable battery pack	Two AA alkaline batteries	Two CR-2025 lithium ion watch batteries	Two AA alkaline batteries	Lithium ion battery pack	Two lithium ion batteries	Two AA alkaline batteries
Rated battery life	24 hours	In use, 1.5 hours; standby, 9 hours; off, 55 hours	25 hours	6 months	25 hours	5.5 hours	In use, 3.5 hours; standby, 35 hours; off, 1 week	36 hours
Battery charging time	N/A	30 minutes	N/A	N/A	N/A	4 hours	2.5 hours	N/A
Service and Support								
24-hour, 7-day live technical support	■	■	■	■	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	90 days/90 days	1 year/1 year	2 years/2 years	3 years/3 years	1 year/1 year	1 year/1 year	1 year/1 year
One year on-site service included	■	■	■	■	■	■	■	■
24-hour turnaround for parts replacement	■	■	■	■	■	■	■	■

* These are preproduction units discussed in "Lightweight Newcomers Add Heavyweight Features." N/A—Not applicable. The product does not have this feature.

Psion Series 5 Handheld Computer



One of our Editors' Choices, the Psion Series 5 Handheld Computer (\$600 street) combines a clever design with a raft of useful applications and utilities written specifically for the operating system EPOC32. These applications are both included with the 8MB Series 5 and available from third parties. The company also licenses EPOC32 to the Geofox-One and to the Philips Mobile Computing Group for use with its GSM digital cellular phones. A powerful PDA that smoothly exports to and imports from Windows 95 and NT applications

◀ The Psion Series 5 Handheld Computer's slide-out keyboard and tilted screen make it especially user-friendly.

PC MAGAZINE
 EDITORS' CHOICE

Texas Instruments Avigo 10	3Com PalmPilot Professional	NEC MobilePro 700	NEC MobilePro 750C	Philips Velo 500	Sharp Mobilon HC-4500C
\$300 street	\$370 street	\$699 direct	\$999 direct	\$840 street	\$1,000 street
Proprietary	Motorola 68328 / 16 MHz	NEC VR 4102 / 54 MHz	NEC VR 4111 / 78 MHz	Philips PR 31700 / 75 MHz	Philips MPS / 75 MHz
Proprietary	Palm OS	Windows CE 2.0	Windows CE 2.0	Windows CE 2.0	Windows CE 2.0
0.8 x 3.3 x 5.5	0.7 x 3.2 x 4.7	1.2 x 9.6 x 4.8	1.2 x 9.6 x 5.4	1.0 x 6.8 x 3.8	1.2 x 7.3 x 3.7
7.0 oz.	5.7 oz.	24.0 oz.	28.8 oz.	15.3 oz.	17.3 oz.
N/A	N/A	16.5 mm	16.5 mm	11.5 mm	14.0 mm
■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
680K / 680K	1MB / 1MB	8MB / 32MB	16MB / 32MB	16MB / 24MB	16MB / 16MB
1MB / 2MB	1MB / 1MB	16MB / 48MB	16MB / 48MB	16MB / 16MB	16MB / 16MB
240 x 180 pixels	180 x 180 pixels	640 x 240 pixels	640 x 240 pixels	640 x 240 pixels	640 x 240 pixels
3.5 x 2.3	3.3 x 2.5	2.6 x 6.9	2.8 x 7.6	2.4 x 5.4	2.3 x 6.0
4 shades of gray	4 shades of gray	4 shades of gray	256 colors	16 shades of gray	256 colors
■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
None	None	One Type II	One Type II	None	One Type II
None	None	Hardware	Hardware	Software	Software
N/A	N/A	33.6/14.4	33.6/14.4	28.8/14.4	33.6/9.6
■	■	■	■	■	■
Two AAA alkaline batteries	Two AAA alkaline batteries	Two AA alkaline batteries	Lithium ion rechargeable battery pack	Nickel hydride rechargeable battery pack	Nickel hydride rechargeable battery pack
1 month	8-12 weeks	30 hours	8 hours	12-15 hours	6 hours
N/A	N/A	N/A	4-5 hours	2.5 hours	3 hours
■	■	■	■	■	■
1 year/1 year	1 year/1 year	1 year/1 year	3 years/1 year	1 year/1 year	1 year/1 year
■	■	■	■	■	■

via the included PsiWin 2.0, the Series 5 is a pleasure to use. A Mac connectivity program is also available for \$79.

When you open the Series 5 case, the keyboard slides neatly forward, and the screen rests at a tilted angle; the result is that the unit seems larger when opened than expected. Weighing in at 12.5 ounces and measuring 0.9 by 6.7 by 3.5 inches, the Series 5 is a reasonable size to carry. Battery life is rated at 35 hours with two double-A cells; an AC adapter is a \$29 option.

Though some might consider the unit's interface a limitation because it is not a Windows 95, CE, or NT clone, the unit's touch-screen application and function icons facilitate system navigation and control. Applications include a word processor and spreadsheet, plus PIM applications, a clock, a calculator, and a sketch pad.

SUITABILITY TO TASK	
Psion Series 5 Handheld Computer	
General use	Excellent
Field/mobile use	Excellent
Handwriting recognition	N/A
Communications	Good

The Series 5's 2-by-5.3-inch 640-by-240-resolution display has a backlight, and in normal room lighting or daylight the screen is quite visible. The unit's keys have a relatively generous 14.3-mm spacing, making the unit fine for creating notes and memos. A convenient voice recorder with ADPCM sound compression captures voice files at 4K per second (8MB of RAM holds 30 minutes of messages). Besides the 8MB of user data storage on our test unit,

the Psion unit has a slot for solid-state flash-memory disks. Other options include a universal travel modem that plugs in to the unit's RS-232 port for \$129 and a PC Card adapter for \$139.—**BB Psion Series 5 Handheld Computer.** Street price: \$600. Psion Inc., Concord, MA; 800-997-7466, 978-371-0310; www.psion.com. Choose 579 at www.pcmag.com/infolink.

Price of tested configuration For devices sold through resellers, assume that street prices will be 10 to 15 percent lower than list prices. Some vendors factor this discount directly into their quoted prices; in such cases we indicate that the cited price is a street price. All street prices are rounded to the nearest \$10. Some vendors sell directly to customers. Such prices are listed as *direct* and are not discounted.

Operating system Windows CE is a more compact version of the Windows operating system, and it comes complete with "pocket" versions of Excel and Word. Psion's EPOC32 is a 32-bit operating system designed for the HPC platform. Most other devices are equipped with proprietary operating systems.

Spacing on built-in QWERTY keyboard The measurements we report indicate how much space there is between two keys, as measured from the center of one key to the center of the next. A standard keyboard has a spacing of 19 mm between each pair. As expected, most of these devices are not equipped with full-size keyboards. Please consult individual reviews for comments on usability.

Installed/maximum RAM Random access memory, the main memory in a computer, is the fastest of the various types of memory, and it is rewritable. It can be erased, however, when the power is shut off.

Installed/maximum ROM Read-only memory is programmed by the vendor at the factory and cannot be altered, even by a power outage. ROM is typically used to store the operating system.

Backlight A backlit screen aids visibility in low-light situations.

Built-in PC Card slots PC Card slots are necessary for adding memory, modem, or network cards. In cases where there are no built-in PC Card slots, an optional external device will often be available to add them.

IrDA port Infrared (IrDA) ports are useful for transferring data from the PIM application to your PC or for printing.



“Could you possibly
be any more



What, getting real work done on the move? That's the promise of the latest Handheld PCs (H/PC) — powered by Microsoft® Windows® CE 2.0. These H/PCs are available now, so you can check your email, review memos, and practice your PowerPoint® presentation during the time it takes to get from Gate A-24 to the next concourse.

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And if your flight gets delayed? Review your schedule, download a file, or build that spreadsheet. Whether you're on the go or stuck waiting somewhere, Windows CE turns downtime into uptime, anytime.

To find out more about Handheld PCs powered by Microsoft Windows CE, go to www.microsoft.com/windowsce/hpc/.

productive?"

Texas Instruments Avigo 10

With the Texas Instruments Avigo 10 (\$300 street), TI has all but duplicated the 3Com PalmPilot Professional (although it does not use a licensed design). Like its exemplar, the Avigo is a wallet-size device designed primarily for storing PIM data and sharing that data with your desktop PC. It lacks an on-screen writing pad and the abundance of third-party software and hardware the PalmPilot has, but it mirrors the PalmPilot in many other respects.

The Avigo even looks like the PalmPilot. Weighing 7 ounces and measuring 0.8 by 3.3 by 5.5 inches, its graphite-gray case has a backlit LCD and a scattering of push keys on the front. Four of these access the unit's primary, easy-to-use PIM applications: the address, schedule, to-do, and memo functions. Users access all the other software features, including an expense tracker, a simple spreadsheet, and a sketch application, via a row of on-screen icons.

Since the unit lacks a physical keyboard, entering PIM data can be tedious. To move around the screen, you must use a stylus pen and a pair of cursor keys. To input text you use a virtual on-screen keyboard: You can use either a straight QWERTY-style keyboard or one with dynamic T9 technology, which groups several characters together on each key and attempts to guess each word you want, but we found this system increases typing speed only slightly. Data can be transferred to or from your PC over a serial connection or via an IrDA port.

To export files to the Avigo from Lotus Organizer 97, the included desktop PIM package, you must use a version of Puma Technology's IntelliSync software. To export digital sketches or spreadsheets, you must launch the proprietary Avigo Manager. By contrast, the PalmPilot cannot handle sketches or standard spreadsheets at all just out of the box. The

Avigo runs for four weeks on two triple-A batteries and has roughly 1MB of RAM.—CM

Texas Instruments Avigo 10. Street price: \$300. Texas Instruments Inc., Dallas; 800-842-2273; www.ti.com/avigo. Choose 581 at www.pcmag.com/infolink.

3Com PalmPilot Professional



Chalk one up to simplicity. The 3Com PalmPilot Professional (\$370 street) has quickly become the market's leading hand-held computing device, despite a limited, proprietary operating system and the absence of a physical keyboard. The PalmPilot has attracted the following—as well as the support of over 3,000 software developers—because of its unaffected reliability. It also wins our Editors' Choice.

The 5.7-ounce unit is just a bit larger than a deck of playing cards. Externally, it consists only of a backlit LCD, six navigational keys, and a stylus. Several PIM application icons reside within the display. Standard PIM applications, an expense tracker, and an e-mail client are included. The latter lets you read, delete, compose, and organize messages; transmission requires additional software and an external 14.4-Kbps 3Com modem (\$129 list).

The unit operates for 8 to 12 weeks on two triple-A batteries and has 1MB of memory—enough for 4,000 addresses, 2,400 appointments, 750 to-do items, and 750 e-mail messages. To enter data, use either the on-screen keyboard or the on-screen

Graffiti-based writing pad, which responds to a form of shorthand and comes with a stick-on guide for easy reference. The software is usable, but it will take you time to learn to write the way the unit requires. 3Com claims a ramp-

up time of about 30 minutes, which we found to be accurate.

Transferring data through a serial connection from the PalmPilot to your PC is straightforward and quick. To synch up, you can also use the 14.4-Kbps modem or an optional LAN kit (\$69 list).

Lotus Notes support as well as myriad third-party applications and hardware add-ons, such as Motorola PageMart paging modules (\$169 to \$189 list), are also available. A version of the PalmPilot is available with 512K of RAM and no e-mail capabilities (\$250 street).—CM

3Com PalmPilot Professional. Street price: \$370. 3Com Corp., PalmPilot Division, Mountain View, CA; 800-881-7256, 847-676-1441; www.palmpilot.com. Choose 582 at www.pcmag.com/infolink. **PC**

◀ The Avigo lacks handwriting-recognition software and the third-party support of the PalmPilot, but it does come with built-in spreadsheet support.
▶ Synchronizing your PalmPilot and your PC is a snap using the included cradle and one-touch-launch HotSynch application.



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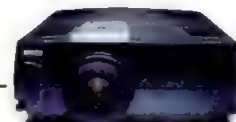
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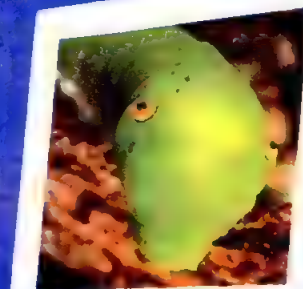
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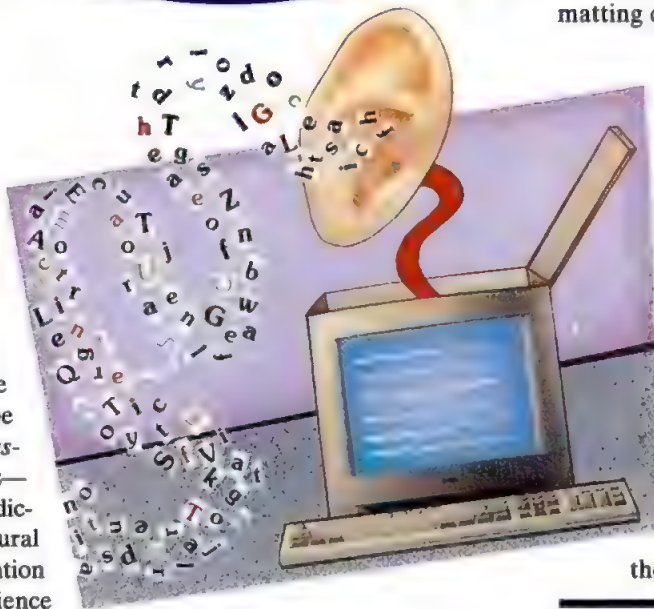
New speech recognition programs have just about everyone talking. But how well do these packages really listen?

By Alfred Poor

Over the past year, you've probably heard a lot of hype about so-called *continuous-speech* recognition programs—software that allows you to dictate to your PC in a relatively natural manner. The arrival of the first dictation programs designed for a wide audience has been greeted with the predictable references to HAL-9000, the fictional computer in *2001: A Space Odyssey*. Although continuous-speech recognition is a major step, the truth is that even the latest dictation programs are still light-years behind HAL's natural-language capabilities, and as our tests revealed, they are not quite

ready to replace your keyboard or mouse as the primary input device.

To find out just how far speech recognition has come in the past year, PC Labs tested two continuous-speech recognition programs: Dragon NaturallySpeaking Preferred Edition 2.0 (\$160 street), from Dragon Systems, and



IBM's ViaVoice (\$75 street), from IBM Corp. A newer version of IBM's package, ViaVoice Gold, was not released in time for testing but is now shipping. The \$120 (street) ViaVoice Gold adds command and control—the ability to control PC-based applications using your voice. NaturallySpeaking Preferred and NaturallySpeaking Deluxe (\$695 list) include command-and-control and support for multiple users. A single-user Personal version (\$100 street) for dictation only is also available. A third major speech vendor, Lernout & Hauspie Speech Products, is planning to release a competitive continuous-speech product, L&H Voice Xpress, this year.

Both NaturallySpeaking and ViaVoice offer impressive features, and we were occasionally surprised at their abilities to decipher seemingly difficult words. But neither came close to the 95 percent accuracy rate we'd like to see in a mainstream consumer product. And we found that making corrections or formatting documents can be painstaking.

In general, our five-member test panel had difficulty getting productive results at first. The good news, however, is that both products will improve over time, so users who can truly benefit from dictation should get good results if they're willing to stick with it.

THE STORY OF SPEECH

Speech recognition itself is nothing new. Dictation systems for specific professions such as radiology have been around for years. Often, these systems carried five-figure

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Our Contributors: ALFRED POOR and BRUCE BROWN are contributing editors of *PC Magazine*. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

SPEECH TECHNOLOGY TIMELINE

LATE 1950S Speech recognition research begins. 1964 IBM demonstrates Shoebox for spoken

price tags and required expensive PCs. Less expensive, general-purpose systems required *discrete speech*, a tedious method of dictation in which you pause after each word. Then a year ago, Dragon Systems achieved a new milestone with the release of NaturallySpeaking, the first general-purpose speech recognition system that allowed you to dictate in a conversational manner. IBM quickly followed with ViaVoice, a direct competitor that cost hundreds of dollars less than the first version of NaturallySpeaking.

A major factor driving the development of these speech-enabled applications is the steady march of computing power. Speech recognition systems demand a lot of processing power and disk space. To take full advantage of speech recognition, we recommend a PC with a Pentium MMX/166 or equivalent processor and at least a 2GB hard disk. Today, you can purchase a system with these specifications for under \$1,000. Before buying any system, though, you should also check to make sure that your speech recognition application supports the included sound card. In general, both

programs support 16-bit Sound Blaster-compatible sound cards, but we found these programs can be quite sensitive to different hardware configurations.

Speech recognition products require all this muscle because they have a complex job. First, the words you speak are captured by microphone and processed by the sound card (both NaturallySpeaking and ViaVoice include noise-canceling headsets). The software then analyzes the sound to distinguish between the lower-frequency vowel

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sounds and the higher-frequency sounds used for consonants. The results are then compared with phonemes (the building blocks of spoken words), groups of phonemes, and words to come up with the most likely matches.

These pattern-matching algorithms must not only be accurate and fast, they must also be flexible to account for variations including tone, pitch, inflection, and rate. In a final effort to yield the most

accurate results, speech recognition systems look at contextual information to predict what words should come next. This also helps the system to distinguish among homonyms, such as *there*, *their*, and *they're*.

NaturallySpeaking and ViaVoice can be used right out of the box after you read a few sentences. To get the best results, however, you should complete the preliminary training session. During the training session, you read selected passages for about 30 minutes. To enhance the system further, you can read additional passages or import documents that contain words you use on an everyday basis into the system.

Although our results were mixed, it's clear that some users could benefit from NaturallySpeaking or ViaVoice if they're willing to invest the time to train the system and become familiar with the dictation process. Though you can be up and running in less than an hour, it may take as long as a month of steady use before you begin to see real results. Professionals who have a genuine need for dictation—combined with an enthusiasm for new technology—will probably have the most luck with this first generation of continuous-speech products. They also hold a lot of promise for those suffering from repetitive stress injuries such as carpal tunnel syndrome.

Editors' Choice

• Not yet



Putting continuous-speech recognition on the desktop is a significant technological feat. We commend these companies for bringing this promising technology so far so

fast. Nevertheless, more work needs to be done before continuous-speech programs are sufficiently accurate and useable to warrant a place on the typical user's desktop. We feel it is too early to designate an Editors' Choice among the first continuous-speech programs. We recommend you wait until the next generation of continuous-speech technology arrives before making the leap.

If you enjoy learning to use new technology and have a real need for dictation, Dragon Systems' Dragon NaturallySpeaking Preferred Edition 2.0 is the

stronger program.

NaturallySpeaking was slightly more accurate on our tests, letting you edit and format text within the included word processor without touching the keyboard or mouse. IBM's ViaVoice offers integration with Microsoft Word out-of-the-box and more text-to-speech features.

Both programs fell short on our recognition tests. Neither achieved an average accuracy of 90 percent. More significant, the programs at times frustrated all five of our testers. Keep in mind, however, that these products should become more accurate and easier to use over time.

OTHER SPEECH APPLICATIONS

Dictation is not the only area where speech technology is making an impact on personal computing. Other areas we covered include command-and-control and text-to-speech, in which words on the screen are converted to speech. Both speech recognition programs we tested include some of these features. Other products offer dedicated command-and-control or bundle it with discrete speech recognition: Dragon Systems' DragonDictate for Windows 3.0, Verbex Voice Systems' Listen 3.0 Deluxe Edition, IBM's Simply Speaking Gold, and Lernout & Hauspie's VoicePlus. IBM's VoiceType Connection for Netscape and Conversa Web are command and control utilities that allow hands-free Web browsing. Text-to-speech products range

digits at New York World's Fair. **1968** The HAL-9000 computer in *2001: A Space Odyssey* introduces the world to speech recognition. **1978** Texas

from applications that simply read back documents, such as First Byte's Monologue 97, to e-mail and messaging systems (Conversa Messenger, Millennia Software's Email Reader Plus, and Webley Systems' Webley).

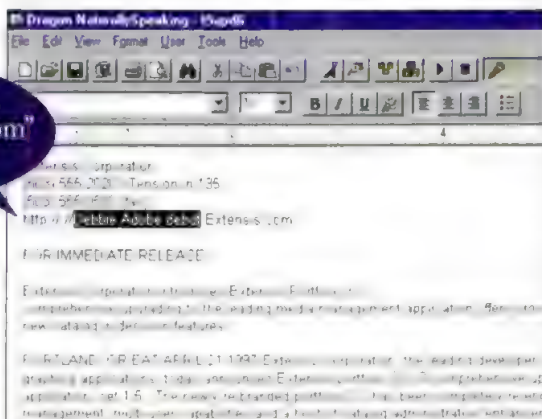
The flurry of developments in dictation, command-and-control, and text-to-speech underscore the critical role speech technology will play in the future of personal computing. Microsoft has made it clear that speech will be a big part of its operating systems and software. So it's not too much of a stretch to imagine that someday soon we'll be using speech to interact naturally with our personal computers. The products reviewed here provide an enticing preview of what's in store.

*We said
"http://www.Extensis.com"
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Dragon Systems Inc.

Dragon NaturallySpeaking Preferred Edition

A longtime player in the speech recognition market, Dragon Systems was the first to achieve the general-purpose continuous-speech milestone, with Dragon NaturallySpeaking in 1997. Now, Dragon has



raised the performance bar again with its Dragon NaturallySpeaking Preferred Edition 2.0 (\$160 street).

This dictation package is aimed at the consumer and SOHO markets, and though it does include extensive format and edit commands, you can dictate only into its custom word processing application. To integrate with other applications, you must download a separate module from Dragon's Web site.

On our tests, NaturallySpeaking was easy to use for basic dictation, even with just a little practice. With an accuracy rate of about 89 percent, it was slightly more accurate than ViaVoice. But you would need to use the product daily to feel at ease with its commands and features—and

Dragon NaturallySpeaking was the more accurate program—but still far from perfect.

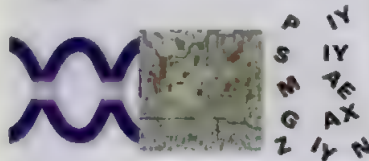
The Engine Behind Speech Recognition

The key to speech recognition is the speech engine—the mechanism that translates sounds into words and sentences. An application interacts with the speech engine through its Speech API (application programming interface), a standard interface that lets developers create their own speech-enabled applications using such engines.

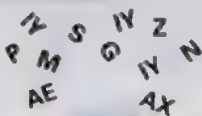
1 AUDIO INPUT The speech engine receives the audio input, or speech, from a microphone via a PC with a standard sound card. The products we tested include noise-canceling headset microphones, and each has a setup routine that helps you to configure the hardware for optimal results.



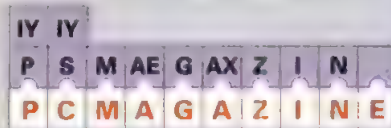
2 ACOUSTIC PROCESSOR The first component of the engine, the acoustic processor, filters out background noise and converts the captured audio into a series of sounds that correspond to phonemes—the fragmentary sounds making up the selected language.



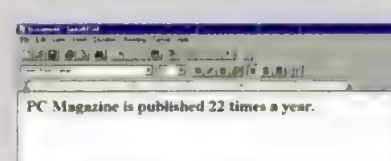
3 WORD MATCHING The speech engine attempts to match the sounds to the most likely words in two basic ways. First, it uses acoustical analysis to build a list of possible words that contain similar sounds. Then it uses language modeling (the likelihood that a given word would appear between those coming before and after it) to narrow the list and come up with the best candidates. The word-matching process draws on the domain employed by the application (the set of vocabularies, pronunciations, and word-usage models, as well as a model of the user's speech and words). A general-purpose product includes a standard domain of 20,000 to 30,000 words designed for a typical office environment.



4 DECODER The decoder selects the most likely word based on the rankings assigned during word matching and assembles the words in the most likely sentence combinations. It then transfers the sentence to the word processing application.



5 THE END RESULT Both Dragon NaturallySpeaking and IBM's ViaVoice include their own word processors. You can save the results in rich text format or cut and paste them into another application. ViaVoice also integrates with a variety of productivity applications (you can download a patch from Dragon's Web site).



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Instruments introduces the first single-chip speech synthesizer and the Speak and Spell toy. 1993 IBM launches the first packaged speech recognition

to achieve an acceptable accuracy level of about 95 percent.

And NaturallySpeaking is no replacement for mouse and keyboard. Its accuracy is good, but we found that when you make a mistake and don't catch it right away, you can correct it more easily by using the keyboard or mouse than with your voice. Dragon bundles microphones from several manufacturers including Labtec and Vxi. The headset with our unit could be worn with the adjustable boom for the microphone on either the left or right side, but it fit more comfortably on the right.

Installation and setup are relatively easy. To train the system, you begin with an Audio Setup Wizard for setting volume levels and rating sound quality. You then read excerpts from a book for half an hour: The choices include Arthur C. Clarke's *3001: The Final Odyssey*, David Barry in *Cyberspace*, and Scott Adams' *Dogbert's Top Secret Management Handbook*.

In addition, you can train the program to recognize specific words and import documents (in DOC, HTML, RTF, and TXT formats) to augment the system's 230,000-word backup vocabulary. (The program keeps only 30,000 words in memory at one time.) You can also add multiple-word phrases, such as *PC Magazine*, complete with the correct capitalization. This version also supports multiple users, though each one must go through training.

A big advantage of NaturallySpeaking is that you don't have to stop dictating in order to edit or make corrections. If you make a mistake, you can just say "Scratch that" and the program deletes the last thing you said. You select words simply by saying them, and you can navigate throughout your document. You can even format the text as you go along or after you've finished dictating.

Say "Correct that" and NaturallySpeaking will open a window with a list of alternatives to the word it thought you said. If the word you want is listed, just say "Choose" followed by the corresponding number on the list. If the word isn't listed, you can spell it, either by saying the letters

cation's menus and dialog boxes. For example, you can say "Click Edit" to open the Edit menu and "Click OK" or "Cancel" to close dialogs. A mouse-grid system lets you move the mouse pointer anywhere rapidly, so you can give commands to click, drag, or right-click.

NaturallySpeaking's numerous editing, formatting, and navigation commands take time to learn. To smooth the process, the program comes with a comprehensive Quick Reference card. In addition, at any time you can ask "What Can I Say?" and NaturallySpeaking will present a list of available commands.

NaturallySpeaking could benefit greatly from integration with other productivity applications out-of-the-box. And even though it's the better continuous-speech product tested here, it still falls short of our expectations.—

Alfred Poor

Dragon NaturallySpeaking Preferred Edition 2.0. Street price: \$160. Requires: Pentium/133-based PC or better, 32MB to 48MB RAM, 60MB hard disk

space, Microsoft Windows 95 or NT 4.0, Creative Labs Sound Blaster-compatible sound card. Dragon Systems Inc., Newton, MA; 800-825-5897, 617-965-5200; www.naturalspeech.com. Choose 523 at www.pcmag.com/infolink.

SUITABILITY TO TASK

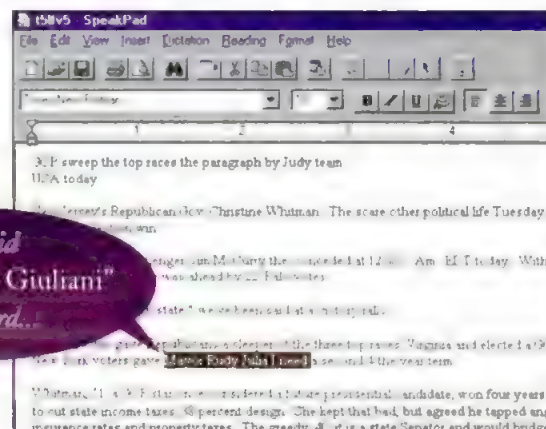
POWER	Dragon NaturallySpeaking Preferred Edition 2.0	ViaVoice
Getting started	Excellent	Good
Dictation	Excellent	Fair
Editing	Excellent	Poor
Application integration	Fair	Excellent
Command and control	Excellent	N/A
EASE		
Getting started	Excellent	Excellent
Dictation	Excellent	Good
Editing	Fair	Good
Application integration	Fair	Good
Command and control	Good	N/A

Getting started reflects the installation and setup procedures for both the software and hardware, initial voice training, and the program's ability to import documents to extend its vocabulary. The core of these programs is **dictation**, for which we evaluate the program's word accuracy, active vocabulary, ability to switch between dictation and command modes, and overall user experience during dictation. No speech recognition program is perfect, and under **editing** we address the program's ability to select text, navigate, perform word corrections, and search and replace text, as well as format documents using voice commands. **Application integration** means the program's ability to work with other productivity applications such as word processors. The final task, **command and control**, involves the support for voice commands within the program to perform tasks such as opening menus, selecting options in dialog boxes, and switching among active windows.

N/A—Not applicable: The product does not have this feature.

or using the international spoken alphabet (Alpha, Bravo . . .). The program can also play the passage and has a text-to-speech feature for reading back entire documents.

In addition, this version includes command-and-control. You control the appli-



Like NaturallySpeaking, IBM's ViaVoice committed its fair share of speech recognition gaffes.

IBM Corp. ViaVoice

A stiff competitor to Dragon NaturallySpeaking, IBM's ViaVoice (\$75 street) is targeted at the general consumer market. The product offers several attractive features, including a highly customizable text-to-speech mode and out-of-the-box integration with Microsoft Word. But ViaVoice wasn't as accurate as NaturallySpeaking on our tests, and it lacks hands-free editing and desktop navigation.



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product, the IBM Personal Dictation System for OS/2 **1993** Apple ships PlainTalk, a series of speech recognition and speech synthesis extensions for the

A new version of the IBM product, ViaVoice Gold (\$120 street), was not ready in time for testing. It includes a larger vocabulary, a backup dictionary of 260,000 words, and speech-enabled command and control (for both navigation and voice correction), plus direct text entry into many Windows applications.

On our tests, ViaVoice was slightly less

accurate than NaturallySpeaking. It had an average score of 88 percent. ViaVoice also becomes more accurate with increased use (within a few weeks, according to IBM's technical support)—especially if you correct errors immediately after they occur.

ViaVoice's correction feature presents a list of possible alternative words and lets you type the correct spelling. Unlike

NaturallySpeaking, which lets you navigate a document and make corrections using voice commands solely, ViaVoice relies on the mouse or keyboard for moving within documents and selecting text.

The actual formatting commands provided in ViaVoice are limited to "New-Paragraph," "New-Line," and some basic capitalization commands. In contrast,

PERFORMANCE TESTS

Speech-Recognition Software



In the world of speech recognition, the acronym WYSIWYG has a slightly different meaning: What You Say Is What You Get. At least, that's the objective.

The results were not always on target.

Our testing was designed to gauge the accuracy of this first generation of continuous-speech

products. Since the ultimate goal of dictation is to save time, we also measured how long it took to complete typical tasks. Although we were impressed with the abilities of these programs when compared with previous, discrete speech products, both programs fell a little short of our expectations on accuracy tests. Our five-member testing panel had trouble getting good and productive results. Keep in mind, though, that results (both accuracy and speed) will improve over time as the program gets used to your vocabulary and speech and as you become accustomed to using a dictation program. Although our tests indicated that the accuracy and usability must improve before speech recognition will become a true mainstream application, certain users will reap significant benefits from these pioneering products.

What the Numbers Mean

After about 45 minutes of setup and training, Dragon NaturallySpeaking Preferred Edition 2.0 had a slight edge (1.3 percent) in accuracy over ViaVoice. On a 350-word document, this translates to 4 additional words deciphered accurately. Neither program broke the 90 percent accuracy barrier on our tests; we consider 95 percent to be the minimum acceptable rate for most users.

More telling is how the accuracy relates to the entire document creation process, including editing and formatting. It took about 5 minutes or less (at an average rate of about 70 to 75 words per minute) just to dictate a 350-word document into NaturallySpeaking and ViaVoice, but it took more than 18 and 13 minutes, respectively,

to correct the same document as we were dictating it into the program. That's not surprising when you consider that a 90-percent accuracy rate on a 350-word document translates to 35 word errors, and that means a lot of corrections. Unlike an OCR program, which may produce misspelled words, a speech recognition program will always yield actual words even if they're not the ones you intended—so a spell-checker is no help during the correcting process.

It should also be noted that although ViaVoice was able to accomplish proofreading and formatting tasks more quickly, the version we tested did not support command-and-control or voice navigation, so we were forced to use the keyboard and mouse to accomplish those tasks. NaturallySpeaking allows you to edit and format documents without touching the keyboard or mouse. The commands take some time to learn, however, so our testers required more time to complete the tasks using this approach.

How We Tested

Each of the five testers performed approximately 30 minutes of training. Before beginning the dictation, we also imported sample documents into each program's Vocabulary Builder to ensure that we would get the most accurate results possible. Using microphones supplied by each vendor, the testers read various documents from our sample test deck, and we examined them for word accuracy. The reviewers then read and

Average Accuracy

Dragon NaturallySpeaking Preferred	89.1%
ViaVoice	87.8%

75% BETTER ►

corrected documents using voice commands where applicable. Last, the reviewers read, corrected, and formatted selected document samples, again using voice commands wherever possible. Both NaturallySpeaking and ViaVoice were tested using a Micron Millennia Pentium/200 with 32MB of RAM and the sound card provided with the system, a Creative Labs Vibra 16 Sound Card.—*Analysis written by Diane Jecker*

▲ High scores are best.
▼ Low scores are best.
Bold type denotes first place.

	Installation/ Configuration	Basic Training	Dictation Tests: 350-Word Document				Dictate, proofread, and format*	
	Minutes:seconds ▼	Minutes:seconds ▼	Dictate (minutes: seconds) ▼	(words per minute) ▲	Dictate and proofread* (minutes: seconds) ▼	(words per minute) ▲	Dictate, proofread, and format* (minutes: seconds) ▼	(words per minute) ▲
Dragon NaturallySpeaking Preferred	7:21	30:23	4:45	74	18:33	19	24:26	14
ViaVoice	10:00	34:35	5:03	69	13:35	26	18:48	19

* We tested NaturallySpeaking using voice commands only. ViaVoice could not complete this test using voice commands.

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Macintosh 1994 Dragon Systems DragonDictate for Windows 1.0 is the first software-only PC-based dictation product. 1996 IBM introduces

NaturallySpeaking lets you select fonts and change their sizes and attributes, adjust paragraph alignment, and create bulleted and numeric lists.

ViaVoice is bundled with an Andrea NC-8 noise-canceling headset/microphone. The headset was comfortable, but the microphone arm was too flexible and required frequent adjustments to keep it away from the speaker's face. With the help of on-screen prompts, you can easily adjust the audio volume of the microphone and headset.

You can begin using ViaVoice after reading just 3 training sentences. But for

better accuracy, you should extend the training to include the full set of 265 sentences. Unlike NaturallySpeaking, ViaVoice requires you to read the default on-screen selections. After you read the sentences to the software, ViaVoice can take 1 hour to build a profile of your speech patterns; Dragon required less than 5 minutes.

Out of the box, ViaVoice includes an active vocabulary of 22,000 words, which you can augment with as many as 42,000 additional words or terms. You can import Microsoft Word, RTF, and text files, and ViaVoice will display a list of the

words and terms it doesn't recognize so you can add them to the vocabulary. To dictate to ViaVoice, use the included, voice-optimized word processor SpeakPad. Or you can use SpeakPad directly with any recent version of Microsoft Word, including Word 97. If Word is installed on your computer, ViaVoice can automatically add a dictation command to the program's menu during installation.

In addition to integrating with Microsoft Word, ViaVoice includes a method for transferring text to any Windows application. To use it, you place the cursor in the application where you want the dictated text to appear, jump to ViaVoice's SpeakPad and select the desired text, and then click the transfer button and move the cursor to the taskbar button for the target application. In practice, we found that this method was no more efficient than using the Windows Clipboard.

ViaVoice has specific modes for spelling words and recognizing numbers, but we found both difficult for new users. The features improve over time with training and correction. But the simple and powerful macro training mode lets you enter words and phrases, and it embeds commands in macros that manipulate other applications.

ViaVoice's text-to-speech feature will read back selected text or a whole document, using one of several preset voices and animated cartoon faces (you can also select a photograph of a baby's face with animated lips). To get the voice just right, you can tweak the tone and frequency.

Although not quite as accurate as NaturallySpeaking, ViaVoice yielded relatively good results with minimal training. Its most serious drawbacks are the lack of voice-controlled navigation and editing. We recommend you spend a little extra to get either NaturallySpeaking or ViaVoice Gold.—Bruce Brown

ViaVoice. Street price: \$75. Requires: Pentium MMX/150-based PC or better or Pentium 166-based PC or better, 32MB to 48MB RAM, 125MB hard disk space, Microsoft Windows 95 or Windows NT 4.0, Creative Labs Sound Blaster-compatible sound card. IBM Corp., Armonk, NY; 800-825-5263, 914-499-1900; www.software.ibm.com. Choose 524 at www.pcmag.com/infolink.

The Continuing Saga of Continuous Speech

Two other leaders in speech technology, Lernout & Hauspie Speech Products and Philips Electronics, have also developed continuous-speech recognition systems. Lernout & Hauspie is also set to compete with Dragon and IBM in retail, whereas Philips is continuing to expand its products for professionals who rely on dictation.

With the acquisition of Kurzweil Applied Intelligence in June 1997, Lernout & Hauspie boosted its efforts to produce a consumer continuous-speech line. The first product of that effort is **L&H Voice Xpress**, which was not ready in time for our testing but should be available by the time you read this.

Voice Xpress is a continuous-speech recognition program that permits users to dictate, edit, and format documents using voice commands based on natural language. In other words, rather than memorizing specific commands, you can use natural words or phrases to control applications.

A speaker-independent application, Voice Xpress requires no initial training. The program has a 30,000-word active vocabulary and includes the ability to analyze documents for augmenting vocabulary. To maximize accuracy, you can choose among speaker profiles for a man, woman, teenager, or child. Lernout & Hauspie claims that regular users will get up to 95 percent accuracy.

Like Dragon NaturallySpeaking, Voice Xpress does not require separate modes for dictation and commands. And it includes text-to-speech and dictation macros.

In addition to Voice Xpress, Lernout & Hauspie will offer Voice Xpress Plus, which adds integration with Microsoft Word 97. Each product will sell for less than \$100 and include an Andrea NC-80 noise-canceling microphone. (Lernout & Hauspie Speech Products NV, Burlington, MA; 800-380-1234, 617-238-0960; www.lhs.com. Choose 556 at www.pcmag.com/infolink.)

Philips Electronics has been in the dictation business for 40 years, but it has not garnered the same amount of attention as other speech vendors here in the U.S., because its products are found primarily in professional fields such as medicine, law, and insurance, where dictation is used extensively.

Philips' main product is **SpeechMagic 2.0** (pricing varies), a natural-language, continuous-speech recognition engine used by developers to add speech recognition to existing applications or to create new speech-enabled tools. SpeechMagic can be used as a standalone application or in a network environment. It includes a 64,000-word active vocabulary and a background dictionary of 270,000 words. If that's not enough to ensure that you get the correct results, you can also make corrections during dictation.

SpeechMagic is available as part of SpeechMagic Suite, Version 2.0, which includes SpeechNote professional dictation and transcription software (SpeechNote) and workflow features (SpeechFlow). It is designed for batch-oriented dictation in high-volume, multiuser environments.

SpeechMagic can be used in conjunction with other Philips products. SpeechPad (\$770 street), for example, is a digital recording device that lets mobile users dictate information on the road and download it later for conversion to text. SpeechMagic also supports the SpeechMike (\$150 street), a unique combination microphone and trackball device. (Philips Electronics, Atlanta; 888-260-6261, 770-821-2400; www.speech.be.philips.com. Choose 557 at www.pcmag.com/infolink.) —John Morris

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MedSpeak/Radiology, the first real-time continuous-speech recognition product. 1996 OS/2 Warp 4 becomes the first operating system to include built-in

COMMAND-AND-CONTROL

Speak

Your Mind

The continuous-speech programs reviewed here are designed for dictation tasks, but the products give you only limited control over your PC. Another class of speech recognition products, known as command-and-control programs, allow you to operate your computer with spoken commands.

We looked at four of the leading command-and-control packages priced from \$60 to \$100. In addition, we looked at a few other products that integrate directly with specific applications such as word processors or Web browsers.

For general command-and-control, DragonDictate for Windows 3.0 offers the most features and works with the broadest range of applications. If you spend most of your time in Microsoft Word, you should also consider Lernout & Hauspie's Kurzweil VoiceCommands.

DragonDictate for Windows 3.0 (\$100 street), from Dragon Systems, is a discrete-speech program that provides command-and-control as well as dictation support for Microsoft Windows 95, Windows NT, and Windows 3.x. The package comes with built-in support for virtually any Windows applications, including Corel WordPerfect Suite, Lotus SmartSuite, and Microsoft Office. You can also add support for other programs using the powerful macro feature. DragonDictate can dictate into any application, and it even supports a wide range of editing and navigation functions during dictation. (Dragon Systems Inc., Newton, MA; 800-825-5897, 617-965-5200; www.naturalspeech.com. Choose 523 at www.pcmag.com/infolink.)

Designed strictly for data entry and command and control, Verbex Voice Systems' **Listen 3.0 for Windows** (\$80 list) cannot be used for standard dictation. The program can display a list of the available

commands, and this list changes depending on the context of your spoken action and which application is active at the time. Listen 3.0 also lets you add new commands for applications. The training process for this product is a bit more difficult than those of other command-and-control products: The requirements include a mind-numbing recitation of font point sizes up to 99, but fortunately you have to do this only once. (Verbex Voice Systems Inc., Edison, NJ; 888-483-7239, 732-225-5225; www.verbex.com. Choose 564 at www.pcmag.com/infolink.)

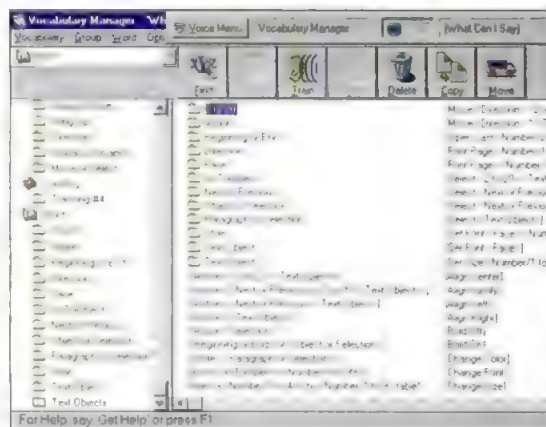
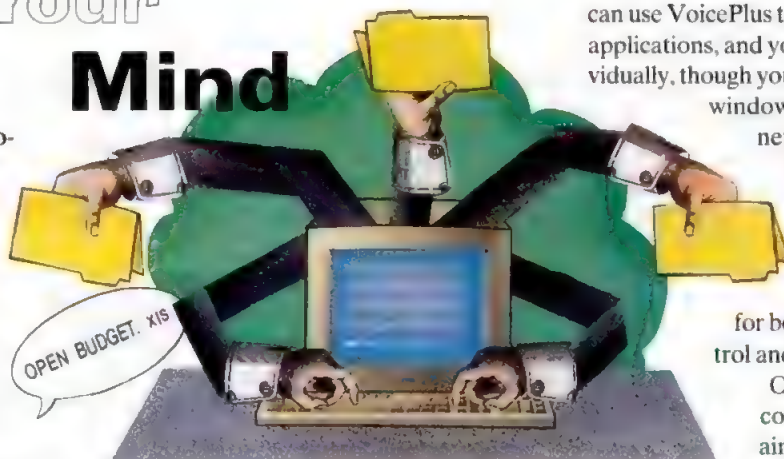
Like DragonDictate, IBM's **Simply Speaking Gold** (\$75 street) is a speech command-and-control program that also supports discrete dictation. The dictation features are more modal; you have to stop dictating before you can use edit commands. The program has a handy "What Can I Say?" window that shows all the general and context-sensitive commands available in your current program. The documentation is minimal, but there is extensive online help. (IBM Corp., Armonk, NY; 800-825-5263, 914-499-1900; www.software.ibm.com. Choose 524 at www.pcmag.com/infolink.)

Lernout & Hauspie Speech Products' **VoicePlus** (\$99 list) is primarily a discrete-speech command-and-control product,

though it can parse a wide range of three- and four-part commands and accepts continuous-speech dictation of numbers. You can use VoicePlus to dictate into Windows applications, and you can spell words individually, though you have to open a special window to use that feature. A new product, **L&H Voice Xpress**, which should be shipping by the time you read this, will offer continuous speech support for both command-and-control and dictation.

Other command-and-control products are aimed at special markets. For example, Lernout & Hauspie's **Kurzweil VoiceCommands** (\$59.95 list) is designed specifically for Microsoft Word. A continuous-speech product, VoiceCommands does not support dictation at all but instead offers editing and formatting commands. It can recognize variations of a command such as "Bold the next two words" and "Make the next two words bold." (Lernout & Hauspie Speech Products NV, Burlington, MA; 800-380-1234, 617-238-0960; www.lhs.com. Choose 556 at www.pcmag.com/infolink.)

Command-and-control is an enhancement to your operating system and productivity applications, but it can also be a great addition to your Web browser. Conversa Web and IBM's VoiceType Connection for Netscape both allow this hands-free surfing experience with Micro-



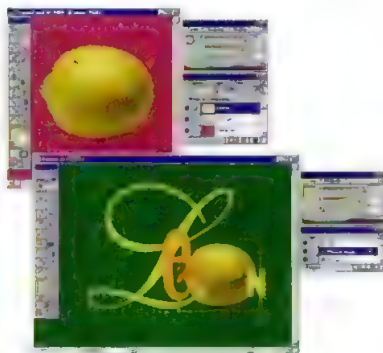
DragonDictate includes predefined commands for common applications such as Word.

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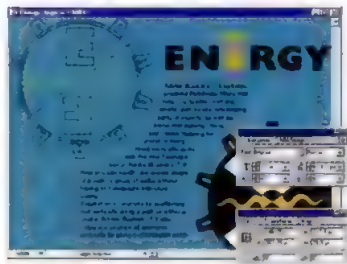
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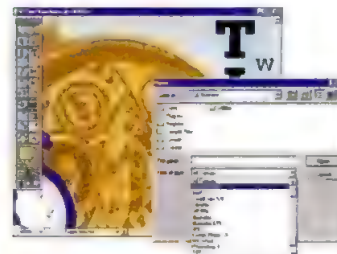
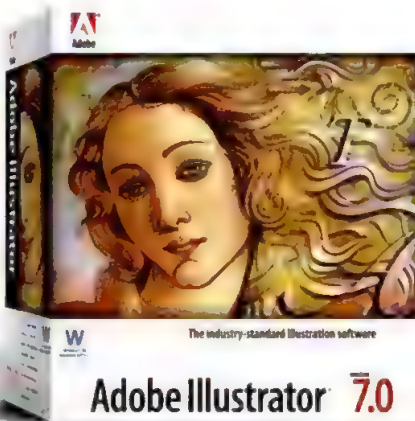
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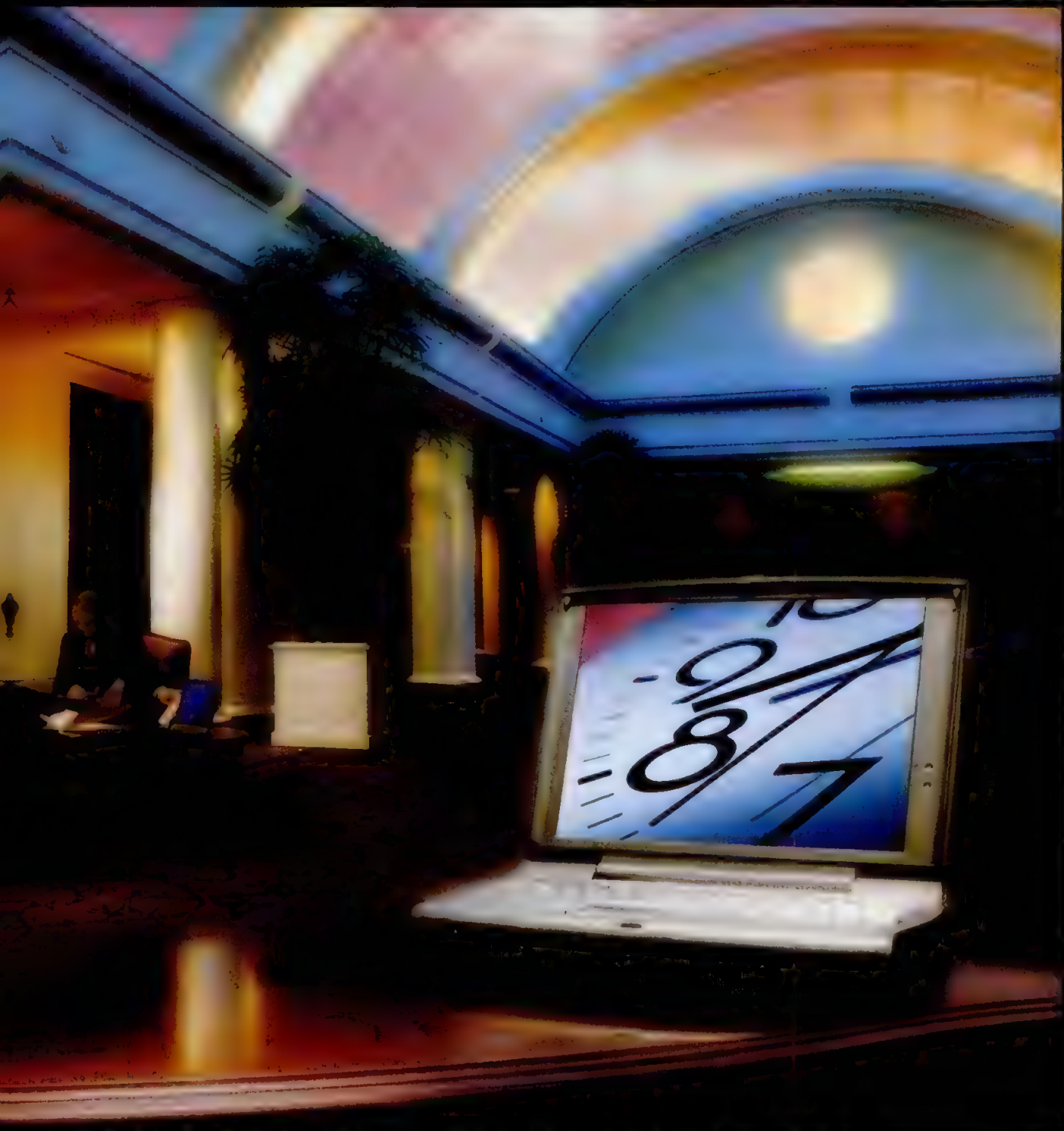
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speech navigation and recognition. **JUNE 1997** Dragon ships NaturallySpeaking, the first general-purpose continuous-speech recognition product. ▶

soft Internet Explorer 4.0 and Navigator 3.x, respectively. The one you choose will probably depend in part on your browser preference, but there are some important differences.

Conversá Web is a plug-in module to Conversá Messenger, a suite of speech-enabled telephony and Internet applications designed for "conversational computing." Available as a public beta at press time, this plug-in, which works as a standalone application with IE4, should be shipping by the time you read this (download, \$29.95 direct; CD-ROM, \$39.95 direct).

Conversá Web has a 110,000-word dictionary and uses natural-language technology to control IE4. Rather than prefacing links with specific commands such as "Go to," you can simply recite the text of the link and Conversá Web will jump to the appropriate page. (Conversá Corp., Redmond, WA; 888-487-4373, 425-558-7554; www.conversa.com. Choose 561 at www.pcmag.com/infolink.)

VoiceType Connection for Netscape (\$13.95 direct from www.sw.net or \$75 street bundled with Simply Speaking Gold) has a more limited set of about 20 commands for jumping to specific URLs, scrolling up and down, and so on within Navigator 3.x. The software does not support Navigator 4.x, however. Based on IBM's continuous-speech recognition engine, the program lacks the natural language capabilities of Conversá Web. It has a 22,000-word dictionary, which is expandable to 64,000 words.

If you have VoiceType 3.0 or any version of ViaVoice or Simply Speaking, however, you can use VoiceType Connection for Netscape to dictate into Netscape's e-mail editor or newsreader and to enter text into Web forms. Conversá Web does not include dictation capabilities and does not integrate with IE4's newsreader or Outlook Express. The separate Conversá Messenger includes an e-mail client. (VoiceType Connection for Netscape. IBM Corp., Armonk, NY; 800-825-5263, 914-499-1900; www.software.ibm.com. Choose 524 at pcmag.com/infolink.)

TEXT-TO-SPEECH

Read

That

Back

to Me



Monologue 97 works by reading text from the Windows Clipboard.

Installation macros included with the program let you place a Speak button directly on the toolbars for Corel WordPerfect 7, Lotus 1-2-3, Lotus WordPro 97, Microsoft Excel, and Word 97. The program comes with 20 SpeechFonts, each with adjustable pitch, speed, and volume. (First Byte Inc., Torrance, CA; 800-757-7707, 402-393-8000; www.fbyte.com. Choose 559 at www.pcmag.com/infolink.)

Both Dragon NaturallySpeaking Preferred Edition 2.0 and IBM's ViaVoice incorporate text-to-speech features. More specialized programs, however, take text-to-speech much further.

First Byte's Monologue 97, for example, reads data aloud, either from the Windows Clipboard or directly from several major productivity applications. Millennia Software's Email Reader Plus 1.06 and Fax Sender are text-to-speech programs designed specifically for e-mail and fax communications. By contrast, Conversá Messenger is a full-featured messaging program that offers both speech recognition and text-to-speech functions. JE Software's JE Mail-Call and Webley Systems' Webley perform similar chores but are telephone-based services rather than software.

Monologue 97 (\$60 street) is the latest version of First Byte's software originally designed to read text files to people with dyslexia as well as to sight- and voice-impaired people. This third edition of Monologue serves as a learning tool, a proofreader, a tape recorder, and an audio aid that enables you to listen to e-mail, documents, or downloaded text from Internet sites while you are commuting or traveling.

Millennia Software's **Email Reader Plus 1.0b** and **Fax Sender** are remote voice-access products. They let you call your office or home PC from any telephone to access e-mail and faxes using AT&T's Watson speech recognition and text-to-speech technology. Both programs require Microsoft Windows 95 TAPI-compliant voice modems.

After installing Email Reader Plus (\$90 street), you access the program by calling the computer from a Touch-tone telephone. You can configure the easy-to-use Email Reader Plus to check for e-mail stored on your computer's hard disk in specified application directories. In addition to reading e-mail subject lines and messages to you over the telephone, Email Reader Plus can also read Microsoft Word e-mail attachments, direct your e-mail program to send a .WAV file, or forward the original e-mail message or attachments to a specified fax number. The program provides female and male voices.

Millennia's other remote voice-access product, Fax Sender (\$50 street), works in a manner similar to Email Reader Plus. It allows you to fax Microsoft Office documents remotely using telephone voice or Touch-tone commands. Fax Sender won't read your incoming faxes to you, but it can retrieve docu-

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*Estimated Street Price. All performance tests conducted by Matrox Graphics Inc. Windows 95 tests conducted on a Dell P2-300 with 512K cache and 64 MB of RAM. Matrox Millennium II, Matrox Mystique 220 Summits, ATI Xpert@Play, Diamond Viper V330, and STB Velocity 128 were tested using driver revisions 3.80, 4.10.2237, 4.10.01.0015, and 4.10.01.0111 respectively. WinBench 98 business tests were conducted at 1024x768 @24-bit and 1280x1024 @24-bit at 75 Hz using small fonts under Windows 95. All trademarks are the property of their respective owners.

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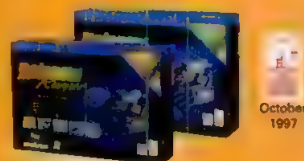
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Diamond Viper V330 (4 MB)	174
ATI Xpert@Play (4 MB)	164
STB Velocity 128 (4 MB)	128

Matrox vs the competition- 1280x1024 @24-bit

Matrox Millennium II (1MB)	198
Matrox Mystique 220 Summits (1MB)	179
ATI Xpert@Play (4 MB)	164
Diamond Viper V330 (4 MB)	161
STB Velocity 128 (4 MB)	128

matrox

AUGUST 1997 IBM ships ViaVoice **FALL 1997** Microsoft CEO Bill Gates identifies speech recognition as a key technological advance.

ments you left on your computer system. (Millennia Software Inc., Saratoga, CA; 408-867-6454; www.msw.com. Choose 560 at www.pcmag.com/infolink.)

A more ambitious program, **Conversá Messenger** is a messaging suite that actually communicates. Conversá Messenger

(\$129.95 direct, \$99.95 for the download) uses a flexible speech recognition engine that allows the user to interact in a natural manner with the program's e-mail, voice mail, and fax functions. For example, if you tell Conversá to send e-mail, the program will ask you whom to send

the message to and then prompt you to begin creating it.

Conversá Messenger's text-to-speech engine allows you to retrieve e-mail and faxes from a telephone, and the program also supports full-duplex speakerphones and answering systems, MAPI-compliant address books, call logging, and mail filtering. The program requires a Unimodem V-capable modem. We looked at a preview version of Conversá Messenger; the final version should be shipping by the time you read this. (Conversá Corp., Redmond, WA; 888-487-4373, 425-558-7554; www.conversa.com. Choose 561 at www.pcmag.com/infolink.)

Like Conversá Messenger, JE Mail-Call and Webley use text-to-speech to transform telephony applications into virtual assistants. The difference is that you don't even need a computer to use these services. Both JE Mail-Call and Webley allow you to retrieve e-mail by dialing in to a server and entering a personal identification number. Webley provides the added security of voice authentication.

Once you've accessed the system, JE Mail-Call reads you the number of messages, headers, senders, and date sent. JE Mail-Call allows you to select a voice and adjust the volume and number of words per minute. You can listen to an entire message or forward it via fax. One advantage of JE Mail-Call is that it leaves messages in your in-box even after you've retrieved them.

JE Mail-Call is available on a subscription basis for \$10.99 per month plus 10 cents per minute. (JE Software, a division of Janesway Electronics, Mount Vernon, NY; 800-431-1348, 914-699-6710; www.jesoft.com. Choose 562 at www.pcmag.com/infolink.)

Webley does more than read e-mail; the program also forwards calls and receives voice mail and faxes. In addition, you can access your messages and faxes via telephone, e-mail, or a secure Web site. Webley responds to voice or telephone keypad commands. The service is \$14.95 a month plus 14.9 cents per minute. (Webley Systems Inc., Schaumburg, IL; 888-444-6400; www.webley.com. Choose 563 at www.pcmag.com/infolink.) **PC**

Giving Voice to Your Applications

In addition to their packaged dictation products, both Dragon Systems and IBM offer tools for power users and developers who wish to leverage the power of their speech engines. Dragon's current solutions are based on DragonDictate, a discrete speech recognition engine, but developer tools and specialized vocabularies for Dragon's NaturallySpeaking should be available by the time you read this. IBM already offers a ViaVoice Developer Tools package.

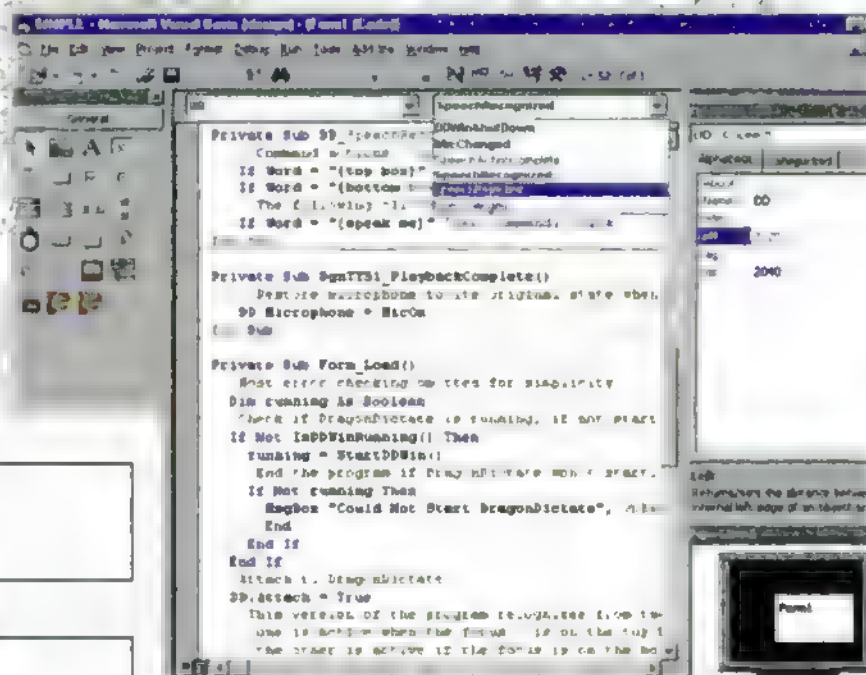
Dragon has several developer options for DragonDictate. First, you can add a specialized vocabulary to DragonDictate using virtually any application, including Microsoft Excel or Word. A family of products called DragonPro includes DragonBusiness, DragonExtra (journalism), DragonLaw, DragonMed, and DragonTech. If you need something even more specific, you can use **Dragon Speech-Tool 1.1** (\$295 list) to develop custom vocabularies and pronunciation guides. You can use the phoneme table and editing controls to create, add, delete, or modify words and pronunciations in vocabulary files, which you can then distribute and run using DragonDictate 2.x or later.

For developers, **DragonXTools 2.0** (\$295 list) supplies 16-bit VBX and 32-bit OCX controls for adding speech features to new or existing applications. DragonXTools also provides the text-to-speech control DgnTTS to give your program a voice of its own. The DragonXTools manual starts with a simple VB example and walks you through the process of creating programs in C and C++, Delphi, Visual Basic, or Visual J++. The manual includes extensive documentation of the events, properties, and procedures you need to talk to DragonDictate.

With DragonXTools, you also get documentation for DragonDictate Macro Language Guide & Reference, a BASIC-like scripting language that developers

can use to add DragonDictate commands, DDE and DLL calls for controlling applications, mouse control, sound effects, and more to their programs. (Dragon Systems Inc., Newton, MA; 800-825-5897, 617-965-5200; www.naturalspeech.com. Choose 523 at www.pcmag.com/infolink.)

IBM's **ViaVoice Developer Tools** (free download) does not provide prebuilt controls, but it fully exposes them so that programmers, especially C and C++ programmers, can tap the ViaVoice dictation system. The toolkit comes with documentation, headers, samples, and utilities for IBM's Speech Manager API (SMAPI), Dictation Macro APIs (DMAPI), and Grammar Compiler APIs for varying levels of customization. To shorten the learning



The DragonXTools controls allow programmers to speech-enable 16- and 32-bit applications.

curve, IBM provides the Starter Set API documentation dictation and command and control.

For C and C++, Lotus Notes, VB, or other ActiveX-supported products, programmers can add personality to their applications with Virtual Voices Control. Microsoft's Speech API (SAPI)-compliant VV Control combines a text-to-speech engine with an animation engine to let you create characters that talk to the user. (IBM Corp., Armonk, NY; 800-825-5263, 914-499-1900; www.software.ibm.com. Choose 524 at www.pcmag.com/infolink.)—Jay Munro

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CD-R and CD-RW DRIVES

TO WRITE OR REWRITE?

CD-R and CD-RW DRIVES

**CD-R
and CD-RW
drives aren't
lame ducks waiting
for recordable DVD. We
test 24 affordable entries.**

By Jonathan Hill

What does recordable CD technology have going for it, and why should you be interested? It's not the sexiest storage paradigm around (DVD is), nor the fastest (look to magnetic drives), nor the one with the multimillion-dollar marketing push (that would be Zip). But CD has two things that together make it a compelling choice for your removable storage needs: low cost per megabyte and near-universal acceptance on PCs.

The prices of *compact disk-recordable* (CD-R) drives and media have fallen to previously unimaginably low levels. You can find blank CD-R media for under \$2 a disk. Combine that with drive bundles that cost \$350

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CD-R and CD-RW DRIVES

CD-R and CD-RW Drives

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or less, and you've got a data-archiving device that is far and away the price-per-megabyte leader. And within the past year, *compact disk-rewritable* (CD-RW) drives began to appear. A little pricier than their CD-R counterparts (typically costing around \$550), CD-RW drives let you use the inexpensive write-once CD-R media for disks you plan to distribute and also let you use and reuse their special CD-RW media (about \$12 per disk), which, over time, can save you money.

For distribution of data, image storage, multimedia presentations, and training and marketing materials, no proprietary solution can hope to approach recordable CD's installed base of CD-ROM playback devices. And although the 650MB storage

capacity of a CD-R or CD-RW disk pales in comparison to the 2.6GB or more promised by the coming rewritable DVD standards, it will be several years before a clear successor to rewritable CDs emerges (for more information, see the sidebar "Recordable DVD: What's All the Bickering About?").

REVIEW CRITERIA

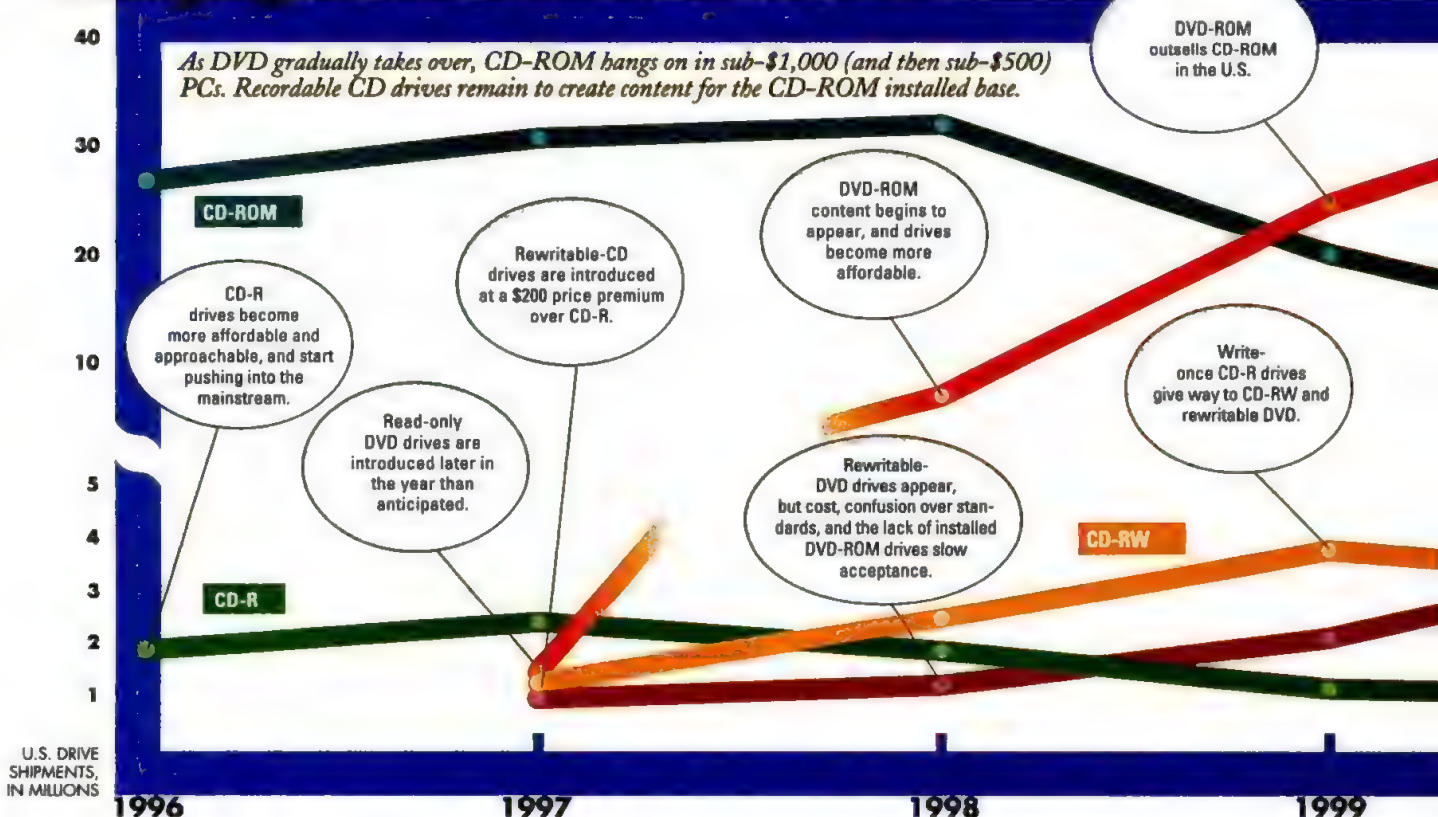
PC Labs tested 14 CD-R and 10 CD-RW drive bundles. Bundles had to include the drives, premastering software, and any necessary cables; units had to be shipping in the U.S. by our test deadline.

If recordable CD's prime advantages are low media costs and the ready availability of compatible CD readers, where

does CD-RW fit in? CD-RW disks have a much lower reflectivity than CD-R or pressed CD-ROM disks and thus cannot be read in the vast majority of installed CD players (though new *multiread* CD-ROM players, with lasers that can adjust to read CD-RW disks, are just now coming to market in volume). Also, CD-RW media are six times as expensive as CD-R disks.

First and foremost in CD-RW's favor is its reusable media. With a CD-R disk, you can add or update files incrementally; but once the disk is full, you cannot delete older files to make more room. A CD-RW drive lets you use a CD-RW disk much as you would any other storage medium, updating and deleting files as needed. And since you can reuse a

Changing of the Guard: CD to DVD



CD-RW disk several times, the media can wind up being less costly in the long run, especially for such tasks as daily backups and archiving.

If you're not sure whether to choose a CD-R drive or a CD-RW drive, the safest bet is to spend the extra money for CD-RW so you'll have all the bases covered. All of the CD-RW drives we tested can also accept the inexpensive CD-R media, so you have the freedom to pick the media that best fits the task at hand—either distribution or archiving.

PACKET WRITING: LIKE A FLOPPY DISK

In a general sense, *packet writing* is simply a means of extending the CD-R multisession specification (also referred to as Orange Book). In the early days of CD-R, an entire volume had to be recorded in a single step. Once you stopped recording, no more data could be added to the disk. Under Orange Book Part II, a single volume can remain open through successive recording sessions, which lets you add more data later on as needed.

Packet writing takes this process a step further, so that a session can remain open

Editors' Choice

- CD-RW: Philips OMNI/12
- CD-R: Smart and Friendly CD-R 4006 Deluxe



Two bundles stood out as robust, easy-to-use drives that worked as promised and merit our Editors' Choice. The OMNI/12 (\$400 street), based on

Philips' own 2X-write/6X-read CD-RW drive, comes bundled with the HyCD software suite from Creative Digital Research. The suite delivers a common user interface for most typical CD creation chores, and the drive successfully completed all our tests (no mean feat). For business, SOHO, and home users who would like a reliable, affordable CD-RW bundle for just a little more than the cost of CD-R, the Philips product is an excellent choice.

Users who burn CDs regularly will want a faster drive, and the CD-R 4006 Deluxe (\$550 street) is the best bundle

in this roundup. Based on a 4X-write/6X-read mechanism from Yamaha, it performed nearly flawlessly on our tests. And the software bundle is the most comprehensive we saw.

Four other products merit an honorable mention. The Mitsumi CR-2600TE (\$350 street), Smart and Friendly CD-R 2006 Plus (\$350 street), and Traxdata TraxWriter CDR2605P (\$500 street), CD-R bundles were relatively problem-free on our tests. And for users leery of opening their PCs, the HP SureStore CD-Writer Plus 7110e (\$499 list) connects to your PC's parallel port for painless installation.

while discrete packets are added. This lets you drag and drop files right onto CD-R or CD-RW drive-letter icons and edit CD-based files directly from within Windows applications, just as you would with a floppy disk. The capability makes recordable CD drives much more useful and accessible to the average PC user.

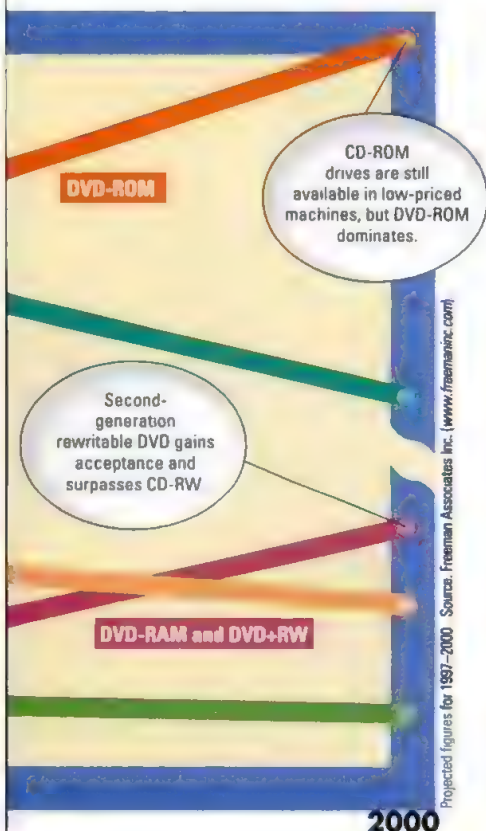
It is important to note, however, that packet-writing techniques were far from mature when we ran our tests. Ten of the bundles in this roundup either did not contain the software needed to enable packet writing or did not have the necessary firmware. Also, none of the CD-RW drives were able to correctly implement true random-erase capability, which lets you reclaim space when you delete a file from a CD-RW disk. Some vendors (including HP, Philips, Plextor, and Ricoh), shipped us flash-BIOS updates and software up-

grades that provide random-erase support, and most vendors should include packet-writing software by the time you read this.

DIFFERENCES IN THE BOX

Although all the bundles we tested delivered the drive and premastering software, there is a tremendous amount of variation even among apparently similar packages. Some vendors, including HP and Sony, have eliminated full-blown premastering software from their bundles, instead delivering discrete modules to cover the basic tasks and leaving it to you to pick the premastering software you prefer.

All but two of the bundles include some form of premastering software from Adaptec. Two years ago, the company bought Incat Systems' Easy-CD Pro and Corel Software's CD Creator. The two products have been merged into Easy-CD



Our Contributors JONATHAN HILL is a frequent contributor to *PC Magazine*. BRUCE BROWN, JAN OZER, ALFRED POOR, and WINN L. ROSCH are contributing editors of the magazine, and JOSH LEVY is a staff editor. JAMES KARNEY is a frequent contributor, and DAVID A. HARVEY is a freelance writer. JAMIE M. BSALES was the senior associate editor in charge of the story, and technical director NICK STAM was the labs project leader.

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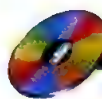
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What's All the Bickering About?

No matter what game you're watching, you can't tell the players without a scorecard—and in this game, you'll find some players on the rosters of more than one team. There's always some confusion surrounding the rollout of any new hardware technology, but moving from recordable CD to the next step—read/write/erase capability for DVD—has resulted in a tangle of overlapping technologies and confusing claims from some of the industry's heavy hitters.

There's certainly sufficient precedent for such turmoil. The DVD standard itself only emerged after last-minute negotiations and compromises between opposing camps. With the press and public harping on the possibility of another Betamax vs. VHS-type showdown, industry leaders have worked hard to find common ground on which to build a unified specification for home video and PC DVD. The ink on the DVD specification was hardly dry, however, when rifts began to appear.

The big breakup in the PC industry is over the specification for DVD drives that can read, write, and erase data. There's a lot at stake in this market segment. Not only does the winning standard stand to make inroads in data backup and removable near-line archive applications, but it could also become the basis for the next home-video recording and playback system, replacing the VHS recorders that are widely used today. But instead of two feuding camps fighting for this prize, there are

four. This situation is even more puzzling, because some companies support more than one standard. Here's a quick overview of the different formats.

• **DVD-RAM.** This was the first rewritable format approved by the DVD Forum, a consortium of companies that established the original DVD specification. Last summer, the group approved the 1.0 specification for DVD-RAM, a phase-change design that can hold 2.6GB of data per side on single- or double-sided disks. The single-sided disks will come in removable cartridges, but to protect the sensitive recording layer, double-sided disks will be permanently mounted in cartridges. At least one DVD-RAM drive manufacturer—Matsushita, which makes Panasonic products—promises that the drives will also be able to read PD/CD phase-change disks.

• **DVD+RW.** The largest faction to split off from the original specification is led by Hewlett-Packard, Philips, and Sony which jointly developed the DVD+ReWritable format, or DVD+RW. Philips and Sony are also members of the DVD Forum and have expressed support for the DVD-RAM specification; they're backing the DVD+RW specification because they believe that it will be better suited for some applications. For instance, Philips has said that future generations of its DVD+RW drive could conceivably write CD-R disks, which means users could create content for the huge installed base of CD-ROM drives.

DVD+RW's single-layer phase-

change disks have more capacity than DVD-RAM disks—3.0GB per side—and use a higher-density recording process. The DVD+RW format does not rely on cartridges to hold the disks.

• **DVD-R/W.** Pioneer has put forth its own specification, which it calls DVD-R/W. This is an evolutionary development based on existing CD-RW technology. It will use random-access media that hold up to 3.95GB. One of this technology's key characteristics is that its phase-change media have a higher reflectivity than DVD-RAM or DVD+RW media, and as a result, can be read in existing DVD-ROM drives and DVD players without modification. Because of this, DVD-R/W drives are not intended to be end-user products but instead are to be used by content developers to create disks that will be read on standard drives.

• **MMVF.** The final contender in this list is the Multimedia Video File format from NEC, also known as MMVF. With a 5.2GB capacity on one side, the disks hold more data than the first versions of the competing designs. One important design goal was to be able to fit a full two-hour movie on one side of the disk. The decision about whether or not to enclose the disks in a cartridge has not yet been made, and drives aren't expected before late 1998.

AND THE WINNER IS...

There may be big money to be made in handicapping this particular race. The brave talk by the players about room for multiple standards may just be

Competing Rewritable-DVD Standards: An Overview

Drive type (and primary supporters)	Capacity per side	READ/WRITE COMPATIBILITY					
		CD-ROM/ Audio CDs	CD-R/ CD-RW disks	DVD-Video/ DVD-ROM disks	Panasonic PD disks	DVD-RAM disks	DVD+RW disks
DVD-RAM Toshiba, Matsushita (Panasonic), Hitachi, Mitsubishi, JVC	2.6GB	Read media	Read media	Read media, write format ¹	Read media	Read and write media	Media not compatible
DVD+RW Sony, Philips, Hewlett-Packard, Ricoh, Yamaha	3GB	Read media, write format ²	Read media, write format ²	Read media, write format	Media not compatible	Media not compatible	Read and write media
DVD-R/W Pioneer	3.95GB	Media not compatible	Media not compatible	Read media, write format	Media not compatible	Media not compatible	Media not compatible
MMVF NEC	5.2GB	Not yet determined	Not yet determined	Read media, write format	Media not compatible	Not yet determined	Not yet determined

(1) By late 1998 some manufacturers plan to produce DVD-ROM drives that will be able to read DVD-RAM disks

(2) Write compatibility is planned for the second generation

whistling in the dark. Just as VHS eventually won out over Beta (at least in the consumer market), buyers are likely to settle on a single technology eventually. But how are you going to pick the winner from this field?

It's important to sift through the competing claims. The DVD+RW camp states it has the advantage, because existing DVD player designs would only require simple modifications to be able to read DVD+RW disks. But according to DVD-RAM proponents, the modifications required to play a DVD-RAM disk on a DVD player should not be significantly more expensive to implement than those for DVD+RW compatibility, even though those modifications are more complex.

Another claim is that the DVD-RAM specification cannot hold a full-length movie on one side. DVD-RAM companies counter that argument by demonstrating blue-laser recording technologies that have already achieved recording densities that could put 15GB on a single-sided DVD-RAM disk. Though blue-laser technology is years away from practical deployment in consumer products, Matsushita has demonstrated 4.7GB-per-side capacities using existing red-laser technology and predicts that such drives will be available by 2000.

A look at similar conflicts in the past indicates there are two factors that are even more important for gaining market share than superior technology: price and availability. There are many market-leading products that may not be technically better than competing designs, but they are priced low enough to be affordable, and they've come to market far enough ahead of the competition that the rest of the pack has never caught up.

It is generally accepted that the DVD-RAM camp will be the first to put products on the shelves. We were promised production units of DVD-RAM drives for testing as part of this story, and while none of the companies managed to make good on those promises, there are strong signs that the products may be available by the

DVD+RW vs. DVD-RAM: Different Strokes

DVD+RW

records only in the grooves in variable packet lengths, at much higher areal density than current DVD-RAM. Advantages: greater capacity now, and write compatibility with current optical technologies such as CD-R.

DVD-RAM

records on both the grooves and lands of an optical disk in fixed packet lengths. Advantages: quicker access times to specified data and huge potential capacity as data areal density increases

time you read this. In contrast, DVD+RW drives won't be ready until later in 1998. If the delay is too long, DVD-RAM may establish a beachhead: an installed base large enough that the other formats may not be able to catch up.

And then there's price. Matsushita (Panasonic) has already announced it intends to price its DVD-RAM drives at \$799 list, with double-sided 5.2GB media set to sell for \$39.95 each, and 2.6GB disks for \$24.95 (which works out to less than a penny per megabyte). The drive will cost a lot more than a CD-R, CD-RW, or high-capacity tape drive, but it won't be too much more expensive than DVD-ROM drives are currently. Prices haven't been announced for drives using the other formats, but it appears that the DVD-RAM companies are ready to be aggressive on pricing to capture market share early.

So if you're a bird-in-the-hand buyer who is willing to take some risk in order to avoid delayed gratification, DVD-RAM appears to be the only game in town for the moment. If you're the more cautious type who prefers to wait for the dust to settle and let other, more pioneering purchasers decide who the winners will be, you may need to wait at least a year for all the players to make it to market.

In the meantime, buy a recordable CD drive and pocket the change. —*Alfred Poor*

Creator, but because premastering software must contain explicit support for different CD-recording hardware, several vendors sent us the older Easy-CD Pro 95 software (which is being phased out by Adaptec but was still available as we tested). As support for their drives is added, most vendors will switch to Easy-CD Creator. Several vendors offer optional packages based on either HyCD from Creative Digital Research or WinOnCD from CeQuadrat. (For a comparison of these applications, see the sidebar "Premastering Software: Comparing the Offerings.")

The packet-writing software market is also largely owned by Adaptec; of the 20 bundles that included some form of packet-writing support, 17 used Adaptec's Direct-CD. One vendor, Plextor, announced that it was switching to CeQuadrat's PacketCD while we were testing. Smart and Friendly uses FloppyCD in its CD-R bundles and DirectCD in its CD-RW products. We found PacketCD to be the most elegant solution to packet-writing needs.

Several bundles impressed us with the breadth and utility of their ancillary software. Plextor's PlexManager is an impressive utility that does a particularly good job of managing CD audio. Ricoh bundles Seagate Technology's Backup Exec with its drive. Smart and Friendly takes a kitchen-sink approach: The company's bundles include a diverse array of utilities and applications, such as CD-inspection tools and image-editing software.

Digital audio has become another important focus for recordable CD drives. Many of the bundles we received include explicit support for cleaning up old LPs (with applets such as Adaptec's Spin Doctor), and digital audio extraction (DAE) lets you create your own customized disks directly from prerecorded CDs. (Note that copyright laws permit you to make only one copy, for personal use, from disks that you have purchased.)

SCSI VS. IDE

Traditionally, recordable CD technology has been a SCSI-only game: You had to install a SCSI host adapter in your machine to connect a CD-R drive. SCSI-based drives still predominate, but nearly every vendor also offers IDE-based recordables, and parallel-port models (such as the HP unit tested in this





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CD-R and CD-RW Drives

	HP SureStore CD-Writer Plus 7110e	Hi-Val 2x8	Hi-Val 2x6x2	JCCom JCD-62R	JCCom JCD-62RW	JVC Professional CD Recording System	Mediastore AVD 4X/6X	Mediastore AVD 2X/6X	Microboards PlayWrite 2062	Mitsumi CR-2600TE	Optima Diskovery 1300
Data archiving	Fair	Good	Good	Good	Good	Good	Good	Good	Good	Excellent	Fair
Backup	Good	Fair	Good	Fair	Poor	Fair	Poor	Poor	Good	Excellent	Fair
Audio CD creation	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Good	Fair
Copy CD-ROM	Excellent	Fair	Fair	Poor	Fair	Poor	Excellent	Good	Fair	Good	Good

For **data archiving** we rate a drive bundle's ability to create a large data archive made up of many small files successfully on-the-fly from both EIDE and SCSI hard disks. Better drives should be relatively robust and fast, recording at or near their rated speeds with few errors and misfires that would require you to start again. You should also be able to add a second session without problems. Better software bundles will not require that you store on your hard disk an

image of the data to be archived before you record it, and they make it easy to choose the proper CD-ROM format.

To rate **backup**, we test a bundle's ability to create packet-written backups of data from both EIDE and SCSI hard disks. The drive's firmware and software should support packet writing, in which the drive is perceived just like any other removable drive by the operating system.

roundup) have begun to appear as well.

SCSI-based drives are generally more versatile and reliable than IDE-based models. We found IDE drives more prone to *buffer underruns*, in which the buffer runs out of data to record and aborts the recording—meaning you have to start again with a fresh disk. To minimize the possibility of buffer underruns, you should not connect the recorder to the same IDE-channel as your intended source; IDE is notoriously poor at multitasking on a single channel. Usually, the hard disk is connected to the primary IDE channel and the CD-ROM drive is hooked to the secondary IDE channel. For best results, change this configuration so that the hard disk and CD-ROM are set as master and slave, respectively, on the primary channel. Then add the CD-R or CD-RW drive to the secondary channel as master.

Our testing also revealed that with many recordable CD drives, you must have a SCSI CD-ROM drive in order to successfully copy CDs. And all recordable CD drives require a SCSI drive to make high-quality reproductions of audio CDs. When we used an IDE CD-ROM drive (common in most PCs), CD copies often didn't work, and audio CDs were full of pops, hisses, and other ill-sounding artifacts.

CD-R and CD-RW technology has matured considerably over the past several years. Whether you are a multimedia developer, a software engineer, a professional musician, or simply a hobbyist, there is no surer way to save and distribute your work than with a CD recorder. And as packet-writing support matures, CD-recordable technology may yet fulfill its role as the floppy disk drive of the nineties.

HP SureStore CD-Writer Plus 7110e

2X write/6X read CD-RW drive. \$499 list (internal IDE), \$610 list (external parallel).

The HP SureStore CD-Writer Plus 7110e is a sturdy and easy-to-use drive, especially in the external parallel-port configuration we tested. Users who want to avoid opening their PCs' cases will find it a welcome choice for data archiving. Note that for involved CD-mastering tasks, you'll need to upgrade the software; HP doesn't include a full-featured premastering package.

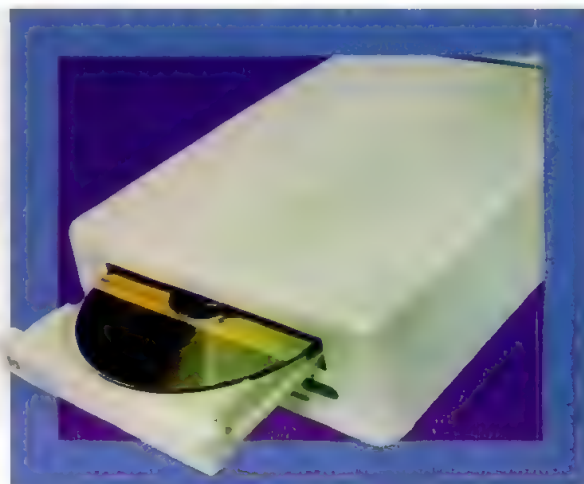
The SureStore does come with Adaptec's packet-writing software, Direct CD 2.0, and two modules from Adaptec's Easy-CD Creator: CD-Copier and Easy CD Audio.

Installing the drive is a snap: Simply connect the supplied cable to your ECP or EPP parallel port, insert the installation CD into your CD-ROM drive, and let HP's Install Assistant do the rest.

The SureStore is not especially fast (because of its parallel-port connection), but it completed our Packet-Writing Backup test without errors in 49:26. Without the full mastering software, however, we could not execute our 300MB Data Archive test. The SureStore successfully completed our CD Copy tests at the claimed 2X write speed, from both an IDE and a SCSI source drive.

Easy-CD Audio supports both IDE- and SCSI-based CD-ROM drives as sources, but you'll want to use a SCSI source drive for clean audio reproduction.

The HP SureStore CD-Writer Plus 7110e is simple to set up and use, and it is



HP's external SureStore CD-Writer Plus 7110e connects to your PC's parallel port.

fine for data archiving. Add a premastering package, and the SureStore can be a contender.—Jonathan Hill

Hewlett-Packard Co., Loveland, CO; 800-810-0134; www.hp.com/go/storage. Choose 505 at www.pcmag.com/infolink.

Hi-Val 2x8, 2x6x2

Hi-Val 2x8: 2X write/8X read CD-R drive. \$350 street (external IDE). Hi-Val 2x6x2: 2X write/6X read CD-RW drive. \$400 street (internal IDE).

These two entries from Hi-Val provide sturdy, consistent performance for home and SOHO PC users, and they are among the least expensive bundles on the market. For simple data archiving and back-

CD-R and CD-RW Drives

PC MAGAZINE
ENTHUSIAST'S CHOICEPC MAGAZINE
ENTHUSIAST'S CHOICE

Philips OMNI/12	Pinnacle Micro RCD 4x4	Pinnacle Micro RWCD 22x	Plextor PlexWriter 4/12max	Ricoh MediaMaster	Smart & Friendly CD-R 2006 Plus	Smart & Friendly CD-R 4006 Deluxe	Smart & Friendly CD-RW 426 Deluxe	Sony Spressa 2x/8x CDU928E Series	Synchrome Maestro CD-R 4x12E	TEAC CD-R55S	Traxdata TraxWriter 2605P	Yamaha CRW4001t- NB
Excellent	Excellent	Fair	Excellent	Good	Good	Excellent	Good	Fair	Fair	Fair	Good	Excellent
Excellent	Good	Good	Fair	Good	Good	Excellent	Good	Excellent	Fair	Excellent	Good	Excellent
Good	Fair	Fair	Good	Fair	Good	Good	Fair	Poor	Fair	Good	Good	Fair
Fair	Fair	Fair	Excellent	Good	Good	Excellent	Fair	Poor	Fair	Excellent	Excellent	Fair

The drive should perform at or near its rated recording speed. Better bundles create disks that are readable by any CD-ROM drive; traditional backup software is a plus.

To merit a rating of **excellent** in **audio CD creation**, a drive has to produce good-quality audio CDs, at the rated recording speed, from both EIDE- and SCSI-source CD-ROM drives. Support for digital audio extraction is a must. The software bundled with the drive should

include a utility expressly for CD audio creation; advanced features such as pop and hiss removal are a definite advantage.

To score well on our **copy CD-ROM** task, a drive must be able to create a usable CD-ROM disk, at the drive's rated speed, from both EIDE- and SCSI-source CD-ROM drives. Better software bundles will include a function specifically for copying CD-ROM titles.

up, these products should prove fine. Note that if you plan to make backup copies of CD-ROM and audio disks, you'll have to have a SCSI CD-ROM drive as the source, not the more standard IDE configuration.

Both packages include documentation only for the bundled hardware components. Installation would have been much easier with a manual to guide users through hardware and software setup. Each unit comes with Adaptec's Easy-CD Creator, and the Hi-Val 2x6x2 adds DirectCD for packet writing. The drives were able to complete all the tasks we asked of them in both Windows 95 and Windows NT—an unusual feat in this roundup.

The Hi-Val 2x8 (which uses a disk caddy) completed our 300MB Data Archive test at the claimed 2X rate, though it trailed most other products at 39:16. Notably, the drive was successful at archiving data while the PC was simultaneously running multiple other tasks. It supports both IDE- and SCSI-source CD-ROM drives for digital audio extraction, but as with all the recorders we tested, a SCSI CD-ROM source delivered better results. And copying a game CD from an IDE CD-ROM drive left us with a useless disk. The copy we made from a SCSI CD-ROM drive, however, was perfect.

The Hi-Val 2x6x2 performed similarly, with nearly identical test times and performance. Disk copying and high-quality digital audio extraction were successful when we used a SCSI-source CD-ROM drive; with an IDE drive, the copy function failed and the audio extraction generated poor-quality playback. The unit

also posted one of the slowest scores in the roundup for packet writing, although the resulting disk was readable in a standard CD-ROM drive. Like its sibling, the Hi-Val 2x6x2 successfully performed a data backup, while the PC was performing multiple other tasks simultaneously.

Although documentation is a weak point, the Hi-Val drives are both good deals for archiving and backup—especially in view of their aggressive prices.

—Bruce Brown

Hi-Val Inc., Santa Ana, CA; 714-953-3000; www.hival.com. Choose 506 at www.pcmag.com/infolink.

JCCom JCD-62R, JCD-62RW

JCD-62R: 2X write/6X read CD-R drive, \$290 street (internal IDE). **JCD-62RW: 2X write/6X read CD-RW drive, \$360 street (internal IDE).**

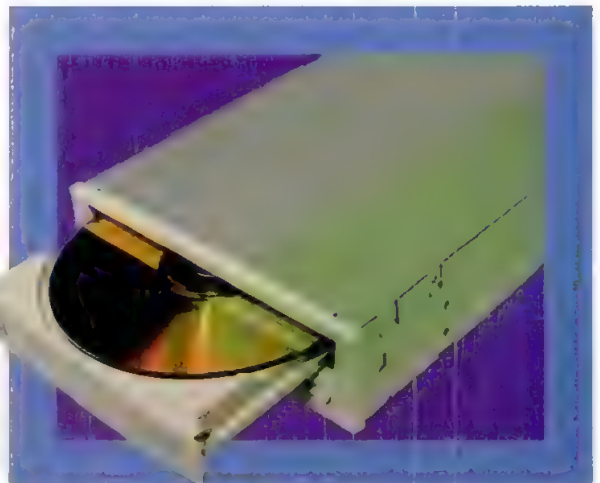
These two bundles from Japan Computers and Communications are attractively priced and could serve for basic data archiving. As with several other products in this roundup, however, the JCD-62R and the JCD-62RW came with early versions of firmware and had some problems executing some of our standard CD recording tasks.

Don't expect detailed instruction manuals with either product, although installation isn't much of a challenge for advanced users. We simply checked the jumper settings, attached the supplied cable to our computer's second IDE connector, booted up,

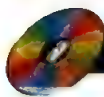
and loaded the software. The JCD-62R comes with Adaptec's mastering package, Easy-CD Pro, and the JCD-62RW ships with Easy-CD Creator, plus DirectCD for packet writing.

During testing, the JCD-62R was unable to complete our 300MB Data Archive test without locking up, suffering a buffer underrun with both IDE and SCSI hard disks as the sources. The JCD-62R also failed to duplicate data correctly on our CD Copy test from an IDE CD-ROM drive, though we could get it to copy at 1X with a SCSI CD-ROM drive as the source.

The JCD-62RW completed the 300MB Data Archive test in 44 minutes—about average for a 2X recorder. It took a relatively long 51 minutes and 20 seconds to complete our Packet-Writing Backup test. On the CD Copy test, the JCD-62RW completed the task using an IDE source, but the copy would not run prop-



Japan Computers and Communications' JCD-62RW is low-priced, but it's not as robust as others we tested.



How Good Is the Bundled Software?

How robust is the software you're getting in your drive bundle? And should you upgrade to the full version if all you get is the "lite" edition? Here is a brief look at the major premastering packages that shipped with the drives we reviewed.

Adaptec's **Easy-CD Creator** is the most popular premastering package. Both the retail version, Easy-CD Creator Deluxe (\$99 list), and the Standard edition present in most bundles include the same Easy-CD Creator program, which runs under Windows 95 and Windows NT 4.0. The difference between the two versions lies exclusively in the extra programs bundled with Easy-CD Creator Deluxe.

These include CD Spin Doctor, for noise removal and burning audio CDs from LPs; Picture CD Creator, for building photo albums on CD; and Video CD Creator, which creates titles for playback on VideoCD devices. Also included with this bundle are an image editor, MGI PhotoSuite; an audio editor; and Session Selector (a viewer for multisession CD-ROM play). Bundled with both the Standard and Deluxe versions is CD Copier, a simple applet for one-step CD duplication.

The Easy-CD program itself is a full-featured, easy-to-use program for simple backup, premastering, and audio CD creation, including jewel case covers and CD labels. The program uses an Explorer-like interface with which you first select the files or directories you wish to copy to the CD-ROM. You can then select recording options in the Layout Properties dialog, and burn the CD.

Our take: Upgrade to the Deluxe version only if you're interested in the advanced functionality provided by the additional programs, since the base program is the same.

Most drives bundled with Easy CD

Creator also include **DirectCD**, Adaptec's low-level driver and applet that make your CD-R or CD-RW drive perform like a hard disk. DirectCD works well, but it doesn't warn you when you're running out of recording space, which is necessary to close the disk so that it can be read by other CD-ROM drives. If your drive doesn't offer DirectCD, you can purchase the software directly from Adaptec for \$69. But check the Adaptec Web site first to see if your drive is compatible with DirectCD. (Adaptec Inc., 800-

er-like file system to drag and drop target files into the recording window. For those seeking professional-looking packaging, the program produces two-page inserts, one-page inlays, and CD-ROM labels.

Our take: The bundled version of WinOnCD has few weaknesses, and only those creating bootable or Mac/Windows hybrid CD-ROMs should upgrade to the retail version. (CeQuadrat USA, 800-330-6734; www.cequadrat.com.)

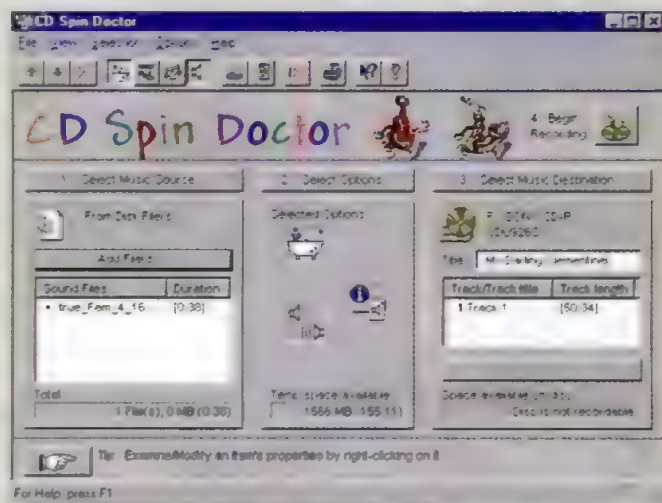
Creative Digital Research's **HyCD**

suite includes the full-featured Publisher program as well as the application-specific Copy, Data, Format, and Music software; each is available in both a Professional version and a more basic Personal version. In general, though the suite leads the pack in cross-platform support, it's definitely behind the curve in its user interface and consumer-oriented feature set.

HyCD's user interface has a distinct 16-bit feel. It's the only program without an integrated, Explorer-like module for selecting files

and that doesn't dynamically track the size of selected files to warn you when you're approaching the 650MB limit. There are also no wizards or templates for creating labels or liner notes. That said, HyCD is the only program for creating shared, hybrid titles supporting the unique requirements of the Macintosh, Windows 3.x/NT/95, and Unix environments.

Our take: During our review, Creative Digital previewed a Java version of its program that promises a vastly improved interface, which should make the product a winner. But today, only users who need extensive cross-platform support should consider spending \$149 to upgrade to the Professional version. (Creative Digital Research, 408-255-0999; www.cdri.com.)—Jan Ozer



Adaptec's CD Spin Doctor, part of Easy CD Creator Deluxe, makes creating audio CDs from old LPs as easy as one, two, three.

442-7274; www.adaptec.com.)

CeQuadrat's **WinOnCD** is a full-featured Windows 95/Windows NT 4.0 program that excels at editing audio files and creating compilation CDs. The bundled version is rich in features, supporting all basic formats plus VideoCD and providing features like .AVI-to-MPEG-1 encoding and real-time noise removal from audio tracks. Missing are the abilities to create bootable or Mac/Windows hybrid CDs, which you can obtain in the upgrade for \$149 (a savings of \$150 from the regular retail price). WinOnCD's wizards support nearly every CD-R function, including complicated operations such as creating VideoCD titles and multisession CD-ROMs. Like Easy-CD Creator, the program uses an integrated, Explor-





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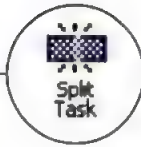
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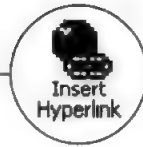
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Date: Wednesday, 4:45 p.m.
To: Planning Committee
Re: One more little thing...

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Recordable CD



Although CD-R and CD-RW bundles attract mainstream business and SOHO users, ease-of-use issues may make such

users think twice. Some recorders don't work well with EIDE hard disks or CD-ROM drives as sources.

What the Numbers Mean

We designed our CD-R and CD-RW tests to highlight the differences in ability among the various drive bundles under Windows 95. We wanted to determine how well each system could handle large CD-ROM XA-format burns (Mode 2, Form 1) with thousands of files, as well as packet-writing burns (if supported), audio duplications, standard CD duplications, and background burns performed simultaneously with standard application functions.

Over the past year, there has been much improvement in CD-R drives' abilities to burn disks using EIDE hard disks as sources (because of better pre-mastering software, faster CD-R drives, and faster mainstream PCs). But SCSI-source hard disks remain much more efficient. Furthermore, CD-RW subsystems are not yet capable of operating at the speeds of their CD-R predecessors. The unique features of CD-RW drives don't always work as advertised, and their packet-writing technology is definitely still experiencing growing pains.

Probably the single most critical factor for obtaining a speedy and accurate burn is the version of pre-mastering and packet-writing CD software included with the drive. Also, a drive's firmware plays an important role in compatibility and capability, as demonstrated in our Labs by the number of drives requiring firmware updates either to improve performance or correct problems. Our advice to buyers is to be sure to get the latest software when you shop and always request the latest firmware updates from vendors for the best results.

erly. We did make a useable copy from a SCSI CD-ROM drive at 2X speed.

As with other drives, audio CDs created from an IDE source drive were full of cracks and pops and generally sounded as if they had been run through a special-effects filter. Using a SCSI CD-ROM as a source, however, yielded fine results.

Neither of these drives will meet the demands of a CD-R power user, and in spite of the IDE interface, you will need a SCSI CD-ROM to perform quality audio and CD-ROM duplication on the fly. But the low prices may convince you to over-

look the limitations.—James Karney
Japan Computer and Communications Inc.,
Torrance, CA; 310-328-3333, www.jccom.com. Choose 507 at www.pcmag.com/infolink.

JVC Professional CD Recording System

4X write/6X read CD-RW drive, \$390 street
(internal SCSI), \$490 street (external SCSI).

Stocked with sophisticated pre-mastering and data archiving capabilities, the JVC Professional CD Recording System deliv-

The **300MB Data Archive** test times how long it takes for a drive to record a complex test-file directory structure containing 16,045 files of various sizes and types, fragmented to simulate typical use.

The Yamaha CRW4001t-NB, a CD-RW drive rated at 4X for writing in CD-R mode, burned up the field with a stellar 11 minutes 4 seconds on this test, thanks largely to its 2MB buffer (most drives we tested have only 1MB). The Pinnacle Micro RWCD 226 failed to burn from our EIDE-source hard disk (even when set to 1X speed), and required a SCSI source drive for a successful burn of 21 minutes. Note that in each case in which a burn failed using an EIDE-source hard disk, we also tried using a SCSI drive. But all of the results posted in our benchmark test charts are based on EIDE source disks, because the vast majority of mainstream PCs are equipped with EIDE drives.

The **Packet-Writing Backup** test uses this same file structure to gauge a drive's ability to back up large groups of files using packet-writing software.

Not all drives support packet writing, which lets you drag and drop files directly onto a CD disk just as you would to a floppy disk drive. Those drives that do support packet writing require special installable file-system software, such as Adaptec's DirectCD or CeQuadrat's Packet CD. The fastest device on our Packet-Writing Backup test was the TEAC CD-R55S.

All products using Adaptec's DirectCD Versions 1.x and 2.x experienced problems with the second portion of our test, which required reviewers to try adding a preexisting 353MB directory

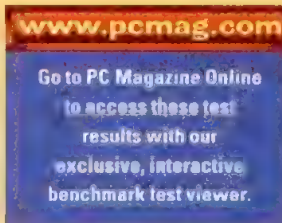
structure to the 313MB of data already written (effectively overstepping the 650MB limit). None of the bundles properly recognized this condition, instead reporting a standard Windows "out of disk space" error in midcopy. And none of the units were able to perform the next phase of the test: closing and fixing the disk for reading in a standard CD-ROM drive.

The **CD-Copy** test measures the time needed to make an exact copy of a mastered game CD using the test-bed's CD-ROM drive as the source drive. The results are based on copying a standard CD from a SCSI CD source drive, because several subsystems (the JCCom JCD-62R, the Microboards Play-Write 2062, the Mitsumi CR-2600TE, the Philips OMNI/12, and both Pinnacle Micro units) couldn't copy from our ATAPI-source CD drive. Most of the drives copied the CD at their rated write speeds, except for the JCCom JCD 62R, which was rated at 2X but which copied at 1X.

Our CD-ROM performance tests—the **ZD CD-ROM Access Time**, **CD-ROM WinMark 98**, and **CD-ROM CPU Utilization** tests—provide an accurate gauge of standard CD-read performance in the CD-R and

ers more high-level features than other bundles we tested. Unfortunately, some critical software pieces were still pending at test time, and their absence hobbled the copying and packet-writing features that most mainstream users expect.

The bundle combines JVC's own drive with an updated version of the company's Professional CD Recording System pre-mastering software. It is also supposed to include Adaptec's DirectCD 2.0 packet-writing software, but this was absent because support for the JVC drive was still in the works when we tested.



CD-RW drives. The Plextor drive, rated at a maximum of 12X, led the pack by a long distance on these tests.

We tested on a Micron Millennia Pentium MMX/233 machine with 32MB of EDO RAM and 512K of L2 cache. We used Western Digital Caviar 34000 4GB EIDE hard disks on the primary IDE channel. We tested with Mode 4 instead of Ultra

DMA to reflect today's volume market more accurately. We used 12X Hitachi IDE CD-ROM drives on the secondary IDE channel. To test from a SCSI source, we added a Plextor 12/20 Plex SCSI CD-ROM drive connected to an Adaptec AHA-2940UW PCI SCSI controller card.—*Analysis written by Nick Stam and Mark Valentine*

▲ High scores are best.
▼ Low scores are best.
Bold type denotes first place within each category.

WRITE TESTS

300MB Data Archive
(min:sec) ▼ (rate) ▲

Packet-Writing Backup
(min:sec) ▼ (rate) ▲

CD Copy
(rate) ▲

READ TESTS

ZD CD-ROM WinMark 98
(thousands of bytes
per second) ▲

CD-ROM
Access Time
(milliseconds) ▼

CD-ROM
CPU Utilization
(percent) ▼

CD-R DRIVES

Hi-Val 2x8	39:16	2X	57:04	2X	313	341	30
JCCom JCD-62R	N/A	N/A	N/A	1X	360	344	30
Mediastore AVD 4X/6X	30:33	4X	N/A	4X	274	355	4
Microboards PlayWrite 2062	31:38	2X	32:04	2X	259	346	4
Mitsumi CR-2600TE	31:37	2X	41:40	2X	529	215	40
Optima Diskovery 1300	53:07	1X	N/A	2X	529	244	4
Pinnacle Micro RCD 4x4	21:44	4X	N/A	4X	415	251	3
Plextor PlexWriter 4/12max	37:42	4X	N/A	4X	728	200	7
Smart & Friendly CD-R 2006 Plus	39:07	2X	43:02	2X	367	320	4
Smart & Friendly CD-R 4006 Deluxe	33:41	4X	45:02	4X	479	224	4
Sony Spresra 2x/8x CDU928E Series	N/A	N/A	30:20	N/A	511	235	53
Synchrone Maestro CD-R 4x12	53:27	1X	N/A	4X	388	286	3
TEAC CD-R55S	51:42	1X	19:25	4X	420	223	3
Traxdata TraxWriter 2605P	29:43	2X	33:20	2X	327	297	4

CD-RW DRIVES

HP SureStore CD-Writer Plus 7110e	N/A	N/A	49:26	2X	325	341	88
Hi-Val 2x8x2	39:09	2X	N/A	2X	504	248	53
JCCom JCD-62RW	44:40	2X	51:20	2X	411	288	30
JVC Professional CD Recording System	24:34	2X	N/A	N/A	363	332	4
Mediastore AVD 2X6X	31:35	2X	N/A	2X	274	355	4
Philips OMNI/12	37:00	2X	46:45	2X	407	310	30
Pinnacle Micro RWCD 226	21:41	2X	N/A	2X	268	348	4
Ricoh MediaMaster	44:53	2X	47:29	2X	273	345	4
Smart & Friendly CD-RW 426 Deluxe	37:15	2X	47:35	4X	506	214	40
Yamaha CRW4001t-NB	11:04	4X	24:23	4X	498	221	40

N/A—Not applicable. The product could not complete this test.

JVC's Professional CD Recording software offers considerably more control over premastering parameters than either Easy-CD Pro or Easy-CD Creator, but its interface can be confusing to users unfamiliar with advanced CD nomenclature. The CD-based documentation is helpful and fairly complete, but the interface has a dated feel, lacking wizards and context-sensitive help. The bundle's greatest strengths are in data archiving and traditional premastering; it allows excellent control over file placement and other professional-level parameters.

Support for audio and CD-data copying is much less robust than that of other packages in this roundup. The software can only extract digital-audio or CD-image information from the JVC drive itself. To create an audio CD from a pre-recorded source, you must first extract the audio to .WAV files onto your hard disk, then record back to the drive. Copying CD-based data is a similar process, requiring intermediate creation of an image file on the user's hard disk.

The Professional CD Recording System performed well on our 300MB Data

Archive tests, completing the burn in a speedy 24:34. Because of the software anomalies, however, we were unable to perform our Packet-Writing Backup and CD Copy tests.

Although the Professional CD Recording System contains some key functionality for premastering professionals, it does not provide a range of features broad enough to satisfy most mainstream users.—*JH*

JVC Professional Computer Products, Cypress, CA; 714-816-6500; www.jvc.net. Choose 522 at www.pcmag.com/infolink.

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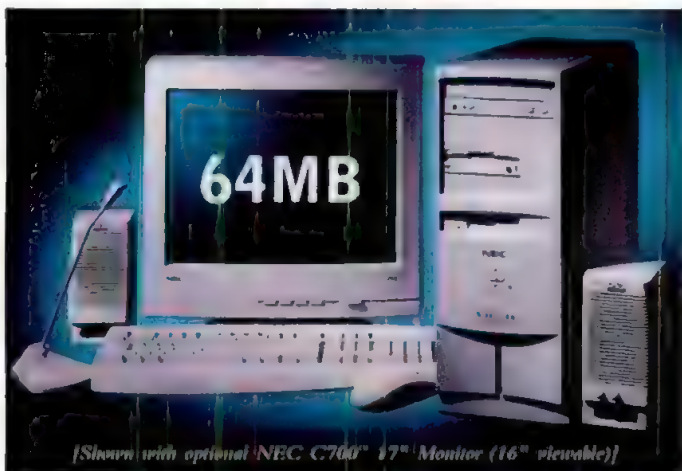
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LABEL IT LIKE A PRO

So you've put your CD-R drive to work and copied data onto a set of blank CD-R disks. Now the challenge is figuring out how to label the information. If you want a more professional-looking option than magic markers and scribbled notes, there are two popular products that might suit your needs.

The **Signature CD Color Printer** (\$1,000 street), from Fargo Electronics, is specially designed for printing full-color images and text directly onto disks or jewel-case



inserts. Capable of resolutions of up to 600-by-300, it includes a somewhat spare software package that lets you type in text or import image files. For best results, use disks with a white coating on the printable side to make the colors really pop; these are available from several vendors, including Fargo itself. (Fargo Electronics Inc., Eden Prairie, MN; 800-327-4622, 612-941-9470; www.fargo.com. Choose 525 at www.pcmag.com/infolink.)

A less expensive, low-tech option is the **Neato CD Labeler Kit** (\$79.95 direct), which contains adhesive labels on sheets that you can insert into your existing printer's paper tray.

After printing, you can peel the labels off and stick them onto your disks. The kit includes a disk holder for centering labels correctly every time you use them. (Neato LLC USA, East Haven, CT; 800-984-9800, 203-466-5170; www.neato.com. Choose 526 at www.pcmag.com/infolink.)

—Josh Levy



Mediastore AVD 4X/6X, AVD 2X/6X

AVD 4X/6X: 4X write/6X read CD-R drive, \$450 street (internal SCSI), \$500 street (external SCSI). AVD 2X/6X: 2X write/6X read CD-RW drive, \$440 street (internal SCSI), \$500 street (external SCSI).

Despite their respectable scores on our timed tests and their attractive prices, the two drive bundles from Mediastore are plagued by insufficient software support, uneven copy quality, and problematic design.

Neither unit came with an installation manual or any troubleshooting documentation, a big problem for less technical users. Both drives ship with Easy-CD Creator and MGI Software's PhotoSuite SE, but packet-writing software is not included.

As with other drives in this roundup, audio tracks copied from a CD in our IDE drive were full of flutter and wow, and pops and whistles. Equally troubling were the results of our multitasking tests on both units. During the burns, no problem was indicated. But afterward, we noticed a tiny, easily missed line of text in the completion dialog box informing us that "errors were encountered." The subsequent session log indicated a buffer run that had killed the burn process. We would much rather have been warned of the problem during the burn itself and would have preferred being alerted in a clearer form.

Both drives delivered respectable results on our 300MB Data Archive and CD Copy tests, recording disks at their claimed speeds. Without packet-writing software, we were unable to perform our Packet-Writing Backup test. And when we installed the AVD CD-RW drive, the outer cover of the tray mechanism seemed flimsy. Halfway through testing, the cover dislodged and prevented the tray from sliding all the way into the recorder—at which point the outer cover fell off.

There are better CD-R and CD-RW bundles available from the competition, with sturdier components and packet-writing software. —David A. Harvey
Mediastore, Inc., Orange, CA;

800-555-5551, 714-974-5551; www.mediastore.com. Choose 508 at www.pcmag.com/infolink.

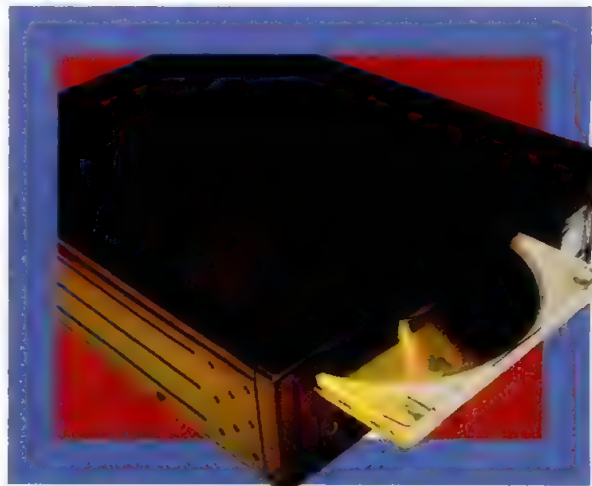
Microboards PlayWrite 2062

2X write/6X read CD-RW drive, \$500 street (internal SCSI), \$550 street (external SCSI).

A competent drive with average performance, the Microboards PlayWrite 2062 is a good choice for experienced PC professionals. But slim documentation makes this one tough going for the PC novice.

Built around a caddy-loading Ricoh drive, the bundle includes Adaptec's Easy-CD Pro, a CD caddy, and DirectCD for packet writing. The bundle is not well suited for those users who are unfamiliar with the intricacies of setting up a SCSI peripheral, as the manual offers neither specific configuration information nor troubleshooting tips. Those interested in a user-friendly setup routine should look elsewhere.

On the plus side, the stable firmware and software helped produce consistently good performance on our 300MB Data Archive and Packet-Writing Backup tests, in which the PlayWrite recorded at the claimed 2X write speed. Be aware that Easy-CD Pro does not recommend or support IDE CD-ROM players for disk copying or audio extraction; you'll have to pair the PlayWrite with a SCSI CD-ROM drive for such tasks. We also had some difficulty formatting an already used RW disk for use with DirectCD. We erased the disk (using Easy-CD) but were unable to initialize it properly for packet writing.



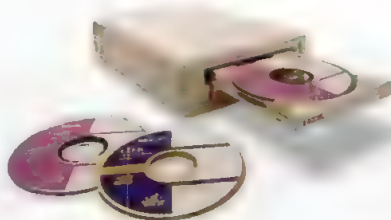
Microboards' PlayWrite 2062 is a competent drive, but thin documentation may put off novices.

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CD-R and CD-RW Drives

Although it's definitely not for those without SCSI experience, the PlayWrite still performs the main tasks that users demand from a CD-RW drive.—**DAH Microboards Technology Inc.**, Chanhassen, MN; 800-646-8881, 612-470-1848; www.microboards.com. Choose 509 at www.pcmag.com/infolink.

Mitsumi CR-2600TE

2X write/6X read CD-R drive, \$350 street (internal IDE).

Mitsumi provides a CD-R bundle that can handle with skill almost all of the tasks you're likely to throw its way. This affordable bundle is based on Mitsumi's own drive, and it ships with both Adaptec's Easy-CD Pro 95 and DirectCD software.

Installation is a snap, thanks to the clear and concise quick-start card. If you run into problems, chances are that the troubleshooting section of the manual will get you back on track quickly. The inclusion of documentation for both the drive and the application programs is invaluable and notably rare among bundles in this roundup.

Performance during our tests was respectable and consistent. The drive kept pace with other 2X recorders on our 300MB Data Archive and CD Copy tests. Performance on our demanding Packet-Writing backup test was also good, with the CR-2600TE turning in an above-average test time of 41:40. Audio quality when recorded from a SCSI source drive (as recommended) was excellent, and the CD-ROM we created under multitasking conditions was perfect.

As CD-R bundles go, the Mitsumi CR-2600TE has all the bases covered. You get an excellent software package, great documentation and Web support, and predictable performance. Mitsumi delivers a drive that works as advertised and, at \$350, is an exceptional value.—**DAH Mitsumi Electronics Corp.**, Irving, TX; 972-550-7300; www.mitsumi.com. Choose 510 at www.pcmag.com/infolink.

Optima DisKovery 1300

2X write/6X read CD-R drive, \$480 street (internal SCSI), \$580 street (external SCSI).

The Optima DisKovery 1300 has a uniquely serviceable case design and good performance compared with other SCSI components. If you have an IDE hard

disk, however, another bundle may provide more robust performance.

The package pairs a Sony drive with Adaptec's mastering software Easy-CD Pro 2.11. The external configuration we reviewed includes a 4-foot SCSI cable; the recommended Adaptec AHA-2940 SCSI host adapter is a \$299 option. The case has an auto-switching internal power module that can run on American or foreign voltage, and you can replace the power supply without tools once you open the case.

The DisKovery was slow on our tests. When paired with an IDE hard disk in our standard test-bed, it performed at only 1X on our complex 300MB Data Archive test, taking a long 53:07. We retested with a SCSI hard disk, and sure enough, performance jumped to 2X. The drive did complete our CD Copy test at the rated 2X speed.

Optima does not include any packet-writing software (though the Sony drive supports it), so we couldn't run our Packet-Writing Backup test. With our AHA-2940 host adapter, the unit sailed through our multitasking tests unscathed.

A fast and powerful drive when paired with a SCSI disk, the DisKovery is a competent performer, though others include packet-writing software for the same price. Take a close look if you need the serviceable case.—**Winn L. Rosch Optima Technology Corp.**, Irvine, CA; 800-411-4237, 714-476-0515; www.optimatech.com. Choose 511 at www.pcmag.com/infolink.

Philips OMNI/12

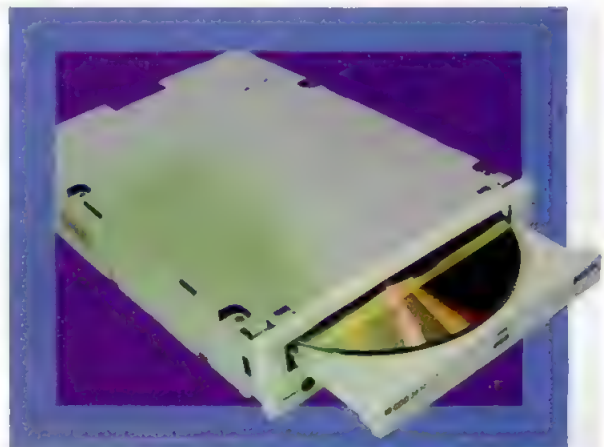
2X write/6X read CD-RW drive, \$400 (internal IDE), \$500 (external IDE).

The Philips OMNI/12 is one of the easiest-to-use CD-RW bundles in this roundup. The OMNI/12 includes a comprehensive and useful software bundle that makes light work of typical recording chores. There are faster drives available, but few are as trouble-free.

Unlike most of this roundup's entries

(which ship with Adaptec premastering software solutions), the OMNI/12 includes HyCD software from Creative Digital Research. HyCD includes four separate modules: Copy, Data, Music, and Personal Publisher. They provide a consistent interface that simplifies most tasks and also provides access to more sophisticated features when needed. Philips also includes Adaptec's DirectCD, for packet writing, and Seagate Backup Exec.

On our tests, the OMNI/12's drive and software worked well together. The drive completed our 300MB Data Archive test at the rated 2X speed (and in the time of 37 minutes). Its performance of 46:45 on our Packet-Writing Backup test was somewhat slow, but considering that many drives



The affordable Philips OMNI/12 was the most hassle-free CD-RW drive we tested.

couldn't complete the test, we're not complaining. We noted that the HyCD software took a long time to close out a session after the data had been written, which added length to the product's test times.

We did find one drawback: The OMNI/12 could not recognize our EIDE CD-ROM drive as a source for the CD Copy test. If you plan to copy CD-ROMs, you'll have to pair the drive with a SCSI source. Still, the OMNI/12 handled most of our test tasks with relative ease.

Given the CD-RW landscape we tested, the OMNI/12 is like a breath of fresh air. With its easy-to-use and flexible software bundle, this affordable package may well encourage CD-R buyers to raise their sights to CD-RW instead.—**AP Philips Components**, San Jose, CA; 800-235-7373, 408-570-5600; www.philips.com. Choose 515 at www.pcmag.com/infolink.



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Pinnacle Micro RCD 4x4, RWCD 226

RCD 4x4: 4X read/4X write CD-R drive, \$550 (internal SCSI), \$650 street (external SCSI). RWCD 226: 2X write/6X read CD-RW drive, \$550 (internal SCSI), \$650 street (external SCSI). Quick, reliable performance distinguishes Pinnacle Micro's RCD 4x4 bundle for buyers seeking a SCSI CD-R drive. The RWCD 226 is a more ambitious CD-RW package that adds greater functionality (including packet writing), but we found it less stable and recommend the RWCD 226 only for experienced users.

The RCD 4x4 comes with Easy-CD Pro and Disk Archive 97. Installation was easy, and we had the drive up and running as soon as we connected it and loaded the software. This drive breezed through our tests; the notable exception was packet writing, which the RCD 4x4 does not support. The drive ran at full 4X speed during our 300MB Data Archive test and posted one of the fastest times in this roundup (21:44). The audio extraction and CD Copy tasks were executed flawlessly at 4X, though you need a SCSI CD-ROM source drive; the RCD 4x4 does not support an IDE CD-ROM source. With a SCSI-source CD drive, the RCD 4x4 is an admirable choice for CD-R functionality.

The higher-end RWCD 226 ships with Adaptec's 1535 SCSI card, DirectCD, Disc Archive 97, and Easy-CD Pro. Setting up the drive was a challenge. The internal cable linking the rear of the drive chassis to the SCSI connector was not attached—a problem we discovered in two different drives. (A company representative blamed the problem on vibration during shipping.)

The RWCD 226 had some difficulties on our timed tests. It failed to complete the Data Archive test from an IDE hard disk at any speed. When we switched to a SCSI source drive, the RWCD 226 completed the task in a quick 21:41. The drive completed our Packet-Writing Backup test as well as the CD Copy test at 2X (but again, a SCSI source CD-ROM drive is required). All in all, some of the other CD-RW bundles we tested

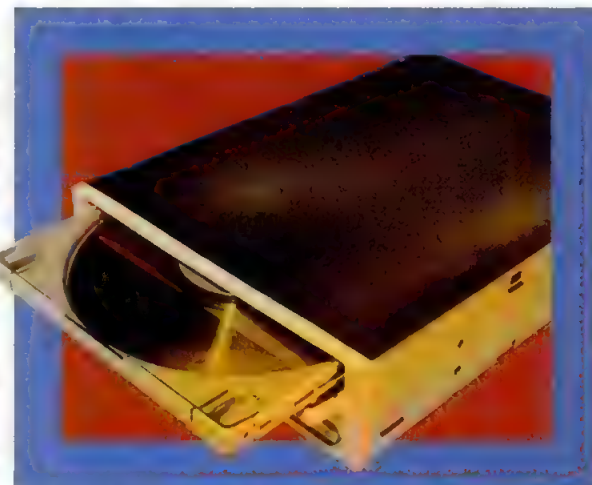
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Pinnacle Micro Inc., Irvine, CA; 800-553-7070, 714-789-3000; www.pinnaclemicro.com. Choose 513 at www.pcmag.com/infolink.

Plextor PlexWriter 4/12max

4X write/12X read CD-R drive, \$550 street (internal SCSI), \$650 street (external SCSI).

Plextor's PlexWriter 4/12max is aimed at power users who want a CD recorder that doesn't compromise on traditional CD-ROM performance. Good performance and a generous software bundle make this package a serious contender.

The 4/12max delivers a 2MB memory buffer (most other drives have just 1MB) and a well-rounded software suite: Adaptec's Easy-CD Creator and DirectCD, CeQuadrat's Packet CD, and Plextor's own Plextor Manager and Disc-Dupe for speedy disk duplication. Plextor is also working on an additional program,



Plextor's 4/12max CD-R drive is quick, and the included software is abundant.

CD Res-Q, which will let you back up and restore a system from a bootable CD-R and also drag and drop audio titles from several CDs onto a single CD-R platter. The well-written, well-illustrated manual outlines clearly defined steps that make installation a simple task. The front of the drive sports four LEDs indicating if a disk is loaded, being read, or being recorded.

Our tests showed this to be a competent drive, completing the 300MB Data Archive and CD Copy tests at full 4X speed. Unfortunately, the packet-writing software included did not yet support this

proprietary Plextor drive (it should by the time you read this), so we could not perform our Packet-Writing Backup test. And like other SCSI drives, it should be paired with a SCSI-source CD-ROM drive for best results in copying audio or data disks. Notably, the drive was the fastest on our CD-ROM benchmark test suite.

Once packet writing is in place, the PlexWriter has the promise of being an outstanding CD recorder for the power user.—JK

Plextor Corp., Santa Clara, CA; 800-886-3935, 408-980-1838; www.plextor.com. Choose 514 at www.pcmag.com/infolink.

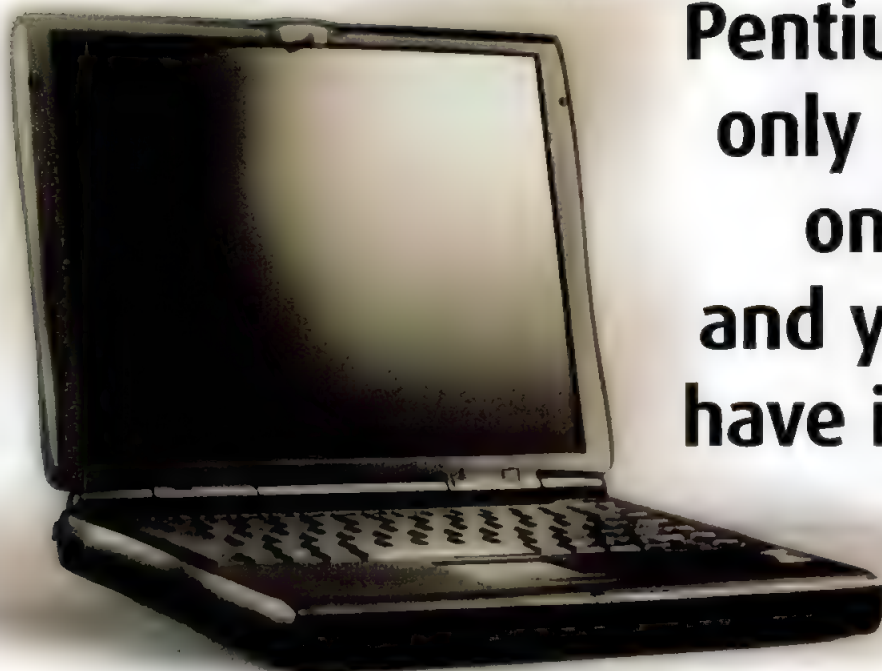
Ricoh MediaMaster

2X write/6X read CD-RW drive, \$699 list (internal SCSI), \$799 list (external SCSI).

Ricoh's MediaMaster shows some of the promise of rewritable CD technology. Early versions of the bundle were plagued by software bugs, but the company now offers flash-firmware revisions and DirectCD updates that release the full potential of CD-RW.

The MediaMaster is built around Ricoh's own drive, which is paired with an ISA-based Practical Enhanced Logic ISA SCSI V-1600 host adapter. A 36-inch SCSI cable is provided in the external configuration we tested, in addition to Adaptec's Easy-CD Creator premastering software and DirectCD for packet writing.

We were surprised to find that Ricoh hasn't got the details right on simple hardware-level things like the CD tray-loading mechanism. During testing, the tray would sometimes slide in askew and fail to close properly. The disk completed our 300MB Data Archive test from an IDE-source hard drive at its rated speed of 2X. The early version of DirectCD that shipped with the drive filled a rewritable disk too full to be processed for reading in other drives—or even to be willingly ejected. With the firmware and DirectCD updates (available on Ricoh's ftp site), however, the drive performed all of our packet-writing tasks reliably, and we were able to free up space on filled CD-RW disks by deleting individual files. No other device was able to perform this feat successfully during our test period.



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CD-R and CD-RW Drives

The MediaMaster went through two firmware revisions between the time of testing and the completion of this review, so just be sure you're getting the latest version.—JH and WLR

Ricoh Consumer Products Group, Sparks, NV; 800-225-1899; www.ricohcpg.com. Choose 515 at www.pcmag.com/infolink.

Smart and Friendly CD-R 2006 Plus, CD-R 4006 Deluxe, CD-RW 426 Deluxe



CD-R 2006 Plus: 2X write/6X read CD-R drive, \$350 street (internal SCSI), \$450 street (external SCSI). CD-R 4006 Deluxe: 4X write/6X read CD-R drive, \$550 street (internal SCSI), \$650 street (external SCSI). CD-RW 426 Deluxe: 2X-4X write/6X read CD-RW drive, \$600 street (internal SCSI), \$700 street (external SCSI).

Easy installation, generous software bundles, and drives that actually work as promised separate these three Smart and Friendly packages from too many others we tested. All three are ripe for the picking.

Installation for all three drives is a snap. The company's CD Consultant installs and configures the bundled software via an integrated wizard, then serves as a source for pointers and technical support information.

All three packages share a robust array of software for virtually every recording need: Macromedia's Backstage Designer Plus for creating Web-based multimedia presentations, ECI Disc Inspector Pro for testing the integrity of copied CDs, and MGI PhotoSuite SE (an image-editing package). Also included are MediaPath's Media Agent for CDs (for accessing CD-ROM drives across a network), Smart and Friendly's own CD-R Disc Jockey (for recording custom audio from multiple CD-ROM drive sources), and CD labeling templates.

Though each drive relies on Adaptec's Easy CD Creator for premastering, the two 4X recorders contain the full Deluxe edition, which includes such niceties as Spin Doctor, VideoCD Creator, and PictureCD Creator.

One minor disappointment in the software bundle was FloppyCD, included with the CD-R 2006 and CD-R 4006 for packet

writing (one of the few competitors to Adaptec's DirectCD, which comes with the CD-RW 426). We could successfully create packet-written disks, but converting a UDF-formatted disk to ISO 9660 format consistently froze the system—requiring a cold boot and resulting in a complete loss of data on the CD.

In our Labs, the two CD-R drives functioned consistently at their rated speeds. The CD-R 2006 completed our 300MB Data Archive and CD Copy tests at 2X and passed our Packet-Writing Backup test. The CD-R 4006 successfully completed our Data Archiving test at a full 4X write speed and had no problem with IDE or SCSI source drives on our CD Copy test.

The CD-RW 426 Deluxe can write to CD-R disks at 4X and CD-RW disks at 2X. On our tortuous 300MB Data Archive test, the drive was unable to record at 4X in CD-R mode successfully. On the plus side, the software correctly recognized that recording at 4X would cause a buffer underrun and the write would fail, so it performed the task at 2X—an acceptable trade-off. It completed the CD Copy test at a full 4X.

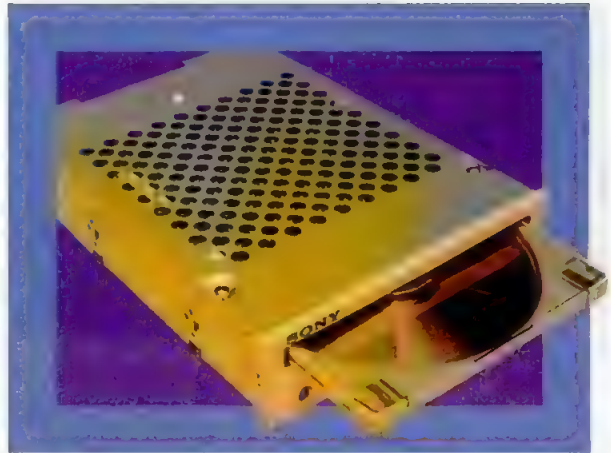
All three of these drives are worthy of your careful consideration. Intelligently designed bundles, a smoothly integrated installation procedure, and a high level of technical support make Smart and Friendly a contender at almost any price point.—JH
Smart and Friendly Inc., Chatsworth, CA; 800-959-7001; www.smartandfriendly.com. Choose 516 at www.pcmag.com/infolink.

Sony Spressa 2x/8x CDU928E Series

2X write/8X read CD-R drive, \$350 street (internal or external IDE).

The affordable Sony Spressa 2x/8x CDU928E Series doesn't do everything, but it is very good at what it does. This IDE-based CD-R drive delivers solid performance, and the low price means money left over for other software to augment the drive's functionality.

Installing the Spressa is not complicated, but the documentation is thin and



The affordable Sony Spressa bundle delivers a competent drive and just enough software to get you started.

incomplete. Oriented toward Windows 3.x, the manual refers to MSCDEX.EXE and other configuration tasks that are not required for Windows 95 installations. Though this won't cause problems for experienced users, it could cross up a novice.

The external model we tested comes only with Adaptec's DirectCD packet-writing software. The drive completed our Packet-Writing Backup test (a task many other drives failed) in a relatively speedy 30:20. Like other drives, however, the Spressa gave no advance warning when we tried to copy too much data to a partially filled disk. This left some of the recorded data inaccessible on a standard CD-ROM drive (but readable by the Spressa). Software to complete our 300MB Data Archive and CD Copy tests was not included.

Overall, the Spressa is a lean package that makes copying files from your hard disk to a CD-R an easy matter—quickly and at an attractive price. If you don't mind adding more robust software, the Spressa is worth a look.—AP

Sony Electronics Inc., San Jose, CA; 800-352-7669; www.sony.com/storagebysony. Choose 517 at www.pcmag.com/infolink.

Synchroma Maestro CD-R 4x12

4X write/12X read CD-R drive, \$500 street (internal SCSI), \$600 street (external SCSI).

The Synchroma Maestro is a speedy CD recorder best suited to professionals with an all-SCSI system. Mainstream users with an IDE hard disk may want to look elsewhere.

The Maestro is built around a fast TEAC drive. Hardware and software

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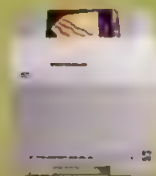


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SUMMARY OF FEATURES

CD-R and CD-RW Drives

	HP SureStore CD-Writer Plus 7110e	Hi-Val 2x8	Hi-Val 2x6x2	JCCom JCD-62R	JCCom JCD-62RW	JVC Professional CD Recording System	Mediastore AVD 4X/6X
■ YES ■ NO							
Products listed in review order							
Price for internal unit	\$499 list	\$350 street	N/A	\$290 street	\$360 street	\$390 street	\$450 street
Price for external unit	\$610 list	N/A	\$400 street	N/A	N/A	\$490 street	\$500 street
Mechanism manufacturer and type	Philips CD-RW	Sony CD-R	Ricoh CD-RW	Philips CD-R	Philips CD-RW	JVC CD-RW	Yamaha CD-R
Write speed/CD-ROM read speed	2X / 6X	2X / 6X	2X / 6X	2X / 6X	2X / 6X	2X / 6X	4X / 6X
Buffer size	1MB	1MB	1MB	1MB	1MB	1MB	2MB
Interfaces supported:							
IDE/Parallel-port	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
SCSI-1/SCSI-2	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Ultra-SCSI/Proprietary SCSI	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
SCSI card included	None	None	None	None	None	Adaptec 2902	None
SCSI or parallel cable included	■	■	■	■	■	■	■
Supports UDF file format	■	■	■	■	■	■	■
Supports Windows drag-and-drop of files	■	■	■	■	■	■	■
Premastering package included	Easy-CD Audio	Easy-CD Creator 3.01	Easy-CD Creator 3.01	Easy-CD Pro 2.11	Easy-CD Creator 3.01	JVC Personal Archiver	Easy-CD Creator 3.01
Analyzes PC configuration for optimal setup	■	■	■	■	■	■	■
Supports disk-at-once recording	■	■	■	■	■	■	■
Supports digital audio extraction for audio	■	■	■	■	■	■	■
CD formats supported:							
Yellow Book/Red Book audio	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Enhanced CD (CD-Plus)/PhotoCD	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
CD-ROM XA (Mode 2, Form 1)	■	■	■	■	■	■	■
CD-ROM XA (Mode 2, Form 2)	■	■	■	■	■	■	■
MultiSession (Orange Book)	■	■	■	■	■	■	■
CD-I/VideoCD (White Book)	■	■	■	■	■	■	■
Backup software included	None	None	None	None	None	None	None
Other software included	Line Pix	None	None	None	CD Copier Deluxe, DirectCD	None	None
Number of blanks CDs included	1	1	1	6	1	1	1
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Toll-free technical support	■	■	■	■	■	■	■
Technical-support hours (western time)	8:00-8:00 M-F	8:00-6:00 M-F	8:00-6:00 M-F	9:30-5:00 M-F	8:00-8:00 M-F	Noon-8:00 M-F	11:00-8:00 M-F
Web site	www.hp.com/go/storage	www.hival.com	www.hival.com	www.jccom.com	www.jccom.com	www.jvc.net	www.mediastore.com

N/A—Not applicable: The drive does not come in this configuration.

installation (Easy CD Pro) are routine, although the scanty instructions are not much help should you need it.

On our tests, when the 4X Maestro was coupled with an IDE hard disk, it could complete our 300MB Data Archive test only at 1X speed. We did see 4X write performance in informal testing with a SCSI hard disk. The Maestro performed our CD Copy test at the full 4X rating, but only with a SCSI source; it recognized an IDE source drive but failed to produce a readable CD copy. No packet-writing software is included with this product.

Although the Maestro package will get professionals humming, mainstream users won't be able to take advantage of the speedy TEAC drive.—WLR

Synchrom Technology, a division of Digital Video Systems, Los Gatos, CA; 408-874-8200; www.synchrom.com. Choose 518 at www.pcmag.com/infolink.

TEAC CD-R55S

4X write/12X read CD-R drive, \$450 street (internal SCSI), \$550 street (external SCSI).

Good Windows 95 performance and a rich software bundle characterize the TEAC CD-R55S. It's targeted at a wide variety of business and professional users, though you need a SCSI hard disk to get the most out of this speedy drive.

The CD-R55S bundle includes the full-featured Adaptec Easy-CD Pro 2.11, Adaptec's DirectCD packet-writing program, and CeQuadrat's easy-to-

use graphical Just Audio software. The Just Audio applet made it easy to create audio CDs from multiple CD audio disks, though as with other drives, you need to use a SCSI-source CD-ROM drive for good audio quality.

The CD-R55S successfully performed all the tasks we asked of it, including multitasking, packet writing, and even making a successful disk copy at 4X speed with an IDE CD-ROM drive as the source. This drive also posted the fastest score in this roundup on our Packet-Writing Backup test (19:25). It was able to perform only at 1X speed, however, on our 300MB Data Archive test with our standard IDE hard disk. A SCSI drive would yield better results.



MediaStore AVD 2X/6X	Microboards PlayWrite 2062	Mitsumi CR-2600TE	Optima DisKovery 1300	Philips OMNI/12	Pinnacle Micro RCD 4x4	Pinnacle Micro RWCD 226	Plexor PlaxWriter 4/12max	Ricoh MediaMaster
\$450 street	\$500 street	\$350 street	\$480 street	\$400 street	\$550 street	\$550 street	\$550 street	\$699 list
\$500 street	\$550 street	N/A	\$580 street	\$500 street	\$650 street	\$650 street	\$650 street	\$799 list
Ricoh CD-RW	Ricoh CD-RW	Mitsumi CD-R	Sony CD-R	Philips CD-RW	Pinnacle CD-R	Pinnacle CD-RW	Plexor CD-R	Ricoh CD-RW
2X/6X	2X/6X	2X/6X	2X/6X	2X/6X	4X/4X	2X/6X	4X/12X	2X/6X
1MB	2MB	1MB	572K	1MB	1MB	1MB	2MB	1MB
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
None	None	None	None	None	Adaptec 1535	Adaptec 1535	Adaptec 2930	MP6200S
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
Easy-CD Creator 3.01	Easy-CD Creator 3.01	Easy-CD Pro 2.11	Easy-CD Pro 2.11	HyCD Suite	Easy-CD Pro 2.11	Easy-CD Pro 2.11	Easy-CD Creator 3.01	Easy-CD Creator 3.01
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
None	None	None	None	Seagate Backup Exec	Disk Archive 97	Disk Archive 97	CD Res-q	Seagate Backup Exec
None	None	None	None	DirectCD	None	DirectCD	Plexor Manager	DirectCD
1 CD-R, 1 CD-RW	2	3	2	2	1	1	2	1 CD-R, 1 CD-RW
1 year	1 year	1 year	1 year	2 years	1 year	1 year	1 year	1 year
■	■	■	■	■	■	■	■	■
11:00-8:00 M-F	8:30-7:00 M-F	8:30-7:00 M-F	10:30-8:00 M-F	9:00-8:00 M-F	24 hours, M-F	24 hours, M-F	8:30-5:30 M-F	8:30-5:00 M-F
www. mediastore.com	www. microboards.com	www. mitsumi.com	www. optimatech.com	www.philips.com	www. pinnaclemicro.com	www. pinnaclemicro.com	www. plexor.com	www. ricohpg.com

The TEAC CD-R55S is a versatile and consistent CD recorder, especially for those with an all-SCSI system.—**BB**
TEAC America Inc., Montebello, CA; 213-726-0303; www.teac.com. Choose 519 at www.pcmag.com/infolink.

Traxdata TraxWriter 2605P

2X write/6X read CD-R drive, \$300 street (internal SCSI), \$500 street (external SCSI).

The Traxdata TraxWriter 2605P CD-recorder kit offers reliable operation at a reasonable price for business and entry-level users. The 2605P worked its way through our test regimen with only minor hiccups, a feat that higher-priced units from better-known manufacturers sometimes failed to do.

Everything you need to get started is in the box. Our bundle came with an internal SCSI version of a Philips drive and Adaptec's Easy-CD Pro 2.11 premastering software (or you can choose Easy-CD Creator or CeQuadrat's WinOnCD). Rounding out the package is DirectCD for packet writing, an Advansys PCI SCSI adapter, two blank CD-R disks, a set of CD-R labeling templates, and a water-based pen suitable for writing on gold CD-R disks. Installation was a snap.

The 2605P was a good performer on our tests. It was one of the faster recorders on our 300MB Data Archive test (outpacing some 4X drives), and it successfully completed our Packet-Writing Backup test, which many others

failed. The 2605P was also able to maintain a 2X write speed on our CD-copy tests, and both IDE- and SCSI-based readers functioned acceptably as source drives for data.

Traxdata has a significant share of the European CD-R market, but the company is virtually unknown in the U.S., where it has been active for less than a year. If the 2605P is any indication, Traxdata is about to lose its anonymity: This particular bundle stands out for the quality of its components and its good performance when you compare it with the competition.—**JH**

Traxdata Inc., Foster City, CA; 888-678-8729, 650-372-2790; www.traxdata.com. Choose 520 at www.pcmag.com/infolink.

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Ends

CD-R and CD-RW Drives

PC MAGAZINE
EDITOR'S CHOICE

■ YES ■ NO

Products listed in review order

	Smart & Friendly CD-R 2006 Plus	Smart & Friendly CD-R 4006 Deluxe	Smart & Friendly CD-RW 426 Deluxe	Sony Spressa 2x/4x CDU928E Series	Synchrome Maestro CD-R 4x12	TEAC CD-R55S	Traxdata TraxWriter 2605P	Yamaha CRW4001t-NB
Price for internal unit	\$350 street	\$550 street	\$800 street	\$350 street	\$500 street	\$450 street	\$400 street	\$650 street
Price for external unit	\$450 street	\$650 street	\$700 street	\$350 street	\$600 street	\$550 street	\$490 street	\$750 street
Mechanism manufacturer and type	Yamaha CD-R	Yamaha CD-R	Yamaha CD-RW	Sony CD-R	TEAC CD-R	TEAC CD-R	Philips CD-R	Yamaha CD-RW
Write speed/CD-ROM read speed	2X / 6X	4X / 6X	2X / 6X	2X / 8X	4X / 12X	4X / 12X	2X / 6X	2X / 6X
Buffer size	1MB	2MB	2MB	512K	1MB	1MB	1MB	2MB
Interfaces supported:								
IDE/Parallel-port	■	■	■	■	■	■	■	■
SCSI-1/SCSI-2	■	■	■	■	■	■	■	■
Ultra-SCSI/Proprietary SCSI	■	■	■	■	■	■	■	■
SCSI card included	S&F 3510a	S&F 3510a	None	None	Adaptec 1505	None	Advansys 930	None
SCSI or parallel cable included	■	■	■	■	■	■	■	■
Supports UDF file format	■	■	■	■	■	■	■	■
Supports Windows drag-and-drop of files	■	■	■	■	■	■	■	■
Premastering package included	Easy-CD Creator 3.01	Easy-CD Creator 3.01	Easy-CD Creator 3.01	Easy-CD Pro 2.11	Easy-CD Pro 2.11	Easy-CD Creator 3.01	Easy-CD Pro 2.11	Easy-CD Creator 3.01 (others available)
Analyzes PC configuration for optimal setup	■	■	■	■	■	■	■	■
Supports disk-at-once recording	■	■	■	■	■	■	■	■
Supports digital audio extraction for audio	■	■	■	■	■	■	■	■
CD formats supported:								
Yellow Book/Red Book audio	■	■	■	■	■	■	■	■
Enhanced CD (CD-Plus)/PhotoCD	■	■	■	■	■	■	■	■
CD-ROM XA (Mode 2, Form 1)	■	■	■	■	■	■	■	■
CD-ROM XA (Mode 2, Form 2)	■	■	■	■	■	■	■	■
MultiSession (Orange Book)	■	■	■	■	■	■	■	■
CD-I/VideoCD (White Book)	■	■	■	■	■	■	■	■
Backup software included	None	None	None	None	None	CeQuadrant CD/BackUp	None	None
Other software included	Backstage Designer Plus, CDR Disc Jockey, others	Backstage Designer Plus, DirectCD, others	Backstage Designer Plus, CDR Disc Jockey, DirectCD, others	None	None	CeQuadrant Just!Audio, Packet CD	None	DirectCD
Number of blanks CDs included	1	1	1CD-R, 1CD-RW	1	1	2	2	2
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year	1 year
Toll-free technical support	■	■	■	■	■	■	■	■
Technical-support hours (eastern time)	8:00 A.M.-9:30 P.M. M-F; 9:00-7:00 Sat., Sun.	8:00 A.M.-9:30 P.M. M-F; 9:00-7:00 Sat., Sun.	8:00 A.M.-9:30 P.M. M-F; 9:00-7:00 Sat., Sun.	7:00 A.M.-10:00 P.M. M-F; 10:00-5:00 Sat.	11:30-7:30 M-F	8:00-5:00 M-F	11:00-8:00 M-F	11:30-8:00 M-F
Web site	www.smartandfriendly.com	www.smartandfriendly.com	www.smartandfriendly.com	www.sony.com/storagebysony	www.synchrone.com	www.teac.com	www.traxdata.com	www.yamahayst.com

Yamaha CRW4001t-NB

2X or 4X write/6X read CD-RW drive, \$650 street (internal IDE), \$750 street (external IDE).

This Yamaha drive was one of the fastest in the roundup, though as with other CD-RW units reviewed here, it took a firmware update midstream for the drive to function as promised.

The CRW4001t-NB offers a 4X write speed for CD-R disks, a 2X write speed for CD-RW disks, and a 6X read speed throughout. Yamaha equips the drive with a 2MB buffer (1MB is the norm). The bundle includes Adaptec's Easy-CD

Creator premastering software and DirectCD for packet writing. Installing the drive was simple despite Yamaha's rather sparse manual, which offered only the most basic information.

When we first tested the drive, we were unable to create CD-R disks at faster than 2X speed, and the drive functioned at 2X on our CD Copy test as well. A firmware upgrade boosted CD-R performance noticeably: The Yamaha turned in the fastest time on our 300MB Data Archive test (a mere 11:04) and copied CDs at the rated 4X. Note that you have to pair it with a SCSI CD-ROM

drive for audio extraction and CD-ROM copies, as the drive failed when paired with an IDE source drive. On the plus side, the drive was one of the best on our Packet-Writing Backup test, with a time of 24:23.

Given the firmware fix, the Yamaha bundle is a good bet for power users who want a fast CD-R drive with CD-RW functionality. When paired with a SCSI CD-ROM system, the drive is a winner.—*JK*
Yamaha Corp. of America, Buena Park, CA; 800-823-6414, 714-522-9011; www.yamaha.com. Choose 521 at www.pcmag.com/infolink. **PC**

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\$1949⁸⁷

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133MHz INTEL PENTIUM® MMX

TOSHIBA

Satellite Pro 440CDX

► 133MHz Intel Pentium® processor with MMX™ technology ► 256KB Level 2 cache ► 16MB EDO RAM standard ► 1.34GB hard drive ► 10X CD-ROM drive ► 12.1" FastScan dual-scan display ► 8-bit color at 800 x 600 resolution ► Windows® 95 or Windows for Workgroups V3.11 operating system ► Weight: 6.9 lbs. ► 3-year parts and 1-year labor warranty

\$1588⁴⁶

CDW 90351

COMPAQ

Armada 1530DM

► 133MHz Intel Pentium® processor with MMX™ technology ► 256KB Level 2 cache ► 16MB EDO RAM standard ► 1.4GB hard drive ► 10X CD-ROM drive ► Integrated 33.6K bps data/fax modem ► 12.1" dual-scan display ► 8-bit color at 800 x 600 resolution ► Windows® 95 operating system ► Weight: 7.4 lbs. ► 1-year worldwide limited warranty

\$1798⁶⁷

CDW 91507

150MHz INTEL PENTIUM® MMX



ThinkPad® 380D

► 150MHz Intel Pentium® processor with MMX™ technology ► 256KB Level 2 cache ► 16MB EDO RAM standard ► 2.1GB hard drive ► 8X CD-ROM drive ► 12.1" active-matrix display ► Windows® 95 operating system ► 1-year limited warranty

\$1998⁸⁷

CDW 86305

TOSHIBA

Tecra 730XCDT

► 150MHz Intel Pentium® processor with MMX™ technology ► 256KB Level 2 cache ► 16MB EDO RAM standard ► 2GB hard drive ► 10X CD-ROM drive ► 12.1" active-matrix TFT display ► Integrated 28.8K bps (V.34) data/fax/voice modem ► Windows® 95 or Windows for Workgroups V3.11 operating system ► 3-year parts and labor warranty, 1-year battery

\$2397⁴⁵

CDW 80957

166MHz INTEL PENTIUM® MMX



ThinkPad® 380ED

► 166MHz Intel Pentium® processor with MMX™ technology ► 256KB Level 2 cache ► 16MB EDO RAM standard ► 2.1GB hard drive ► 20X CD-ROM drive ► 12.1" dual-scan display ► 32-bit CardBus and Zoomed Video support ► Windows® 95 operating system ► 1-year limited warranty

\$1799⁹⁶

CDW 94542



200MHz INTEL PENTIUM® MMX

COMPAQ

Armada 7360DMT

► 200MHz Intel Pentium® processor with MMX™ technology ► 256KB Level 2 cache ► 32MB EDO RAM standard ► 3GB hard drive ► 33.6K bps modem ► 12.1" active-matrix display ► 32-bit CardBus and Zoomed Video support ► Windows® 95 operating system ► 3-year limited warranty

\$3715⁴⁷

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CDW 94545

233MHz INTEL PENTIUM® MMX



ThinkPad® 770

► 233MHz Intel Pentium® processor with MMX™ technology ► 512KB Level 2 cache ► 32MB SyncDRAM standard ► 5.1GB hard drive ► 14.1" active-matrix display ► 33.6K bps data/fax modem ► Windows® 95 operating system ► Weight: 7.82 lbs. ► 3-year parts and labor warranty

\$4998⁸⁷

CDW 94547

266MHz INTEL PENTIUM® MMX

COMPAQ

New! Armada 4220T

► 266MHz Intel Pentium® processor with MMX™ technology ► 512KB Level 2 cache ► 32MB EDO RAM standard ► 4GB hard drive ► 12.1" active-matrix SVGA display ► 64-bit graphics subsystem with 2MB EDO video RAM ► Windows® 95 operating system ► 3-year worldwide limited warranty

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\$929⁵⁸

CDW 92269



IBM PC 300GL

▶ 166MHz Intel Pentium® processor with MMX™ technology ▶ 256KB Level 2 cache ▶ 16MB SDRAM standard ▶ 2.5GB EIDE hard drive ▶ Cirrus Logic 5446 graphics ▶ LANdesk client manager ▶ Windows® 95 ▶ 3-year limited warranty

\$874³⁸

CDW 89298

200MHz INTEL PENTIUM® MMX

COMPAQ

Deskpro 2000

▶ 200MHz Intel Pentium® processor with MMX™ technology ▶ 256KB Level 2 cache ▶ 16MB SDRAM standard ▶ 2.1GB EIDE hard drive ▶ Integrated S3/V2 enhanced 64-bit graphics ▶ Windows® 95 ▶ Intelligent Manageability ▶ 3-year limited warranty

\$969⁸⁹

CDW 92840



**HEWLETT®
PACKARD**

HP Brio 8014 PC

▶ 200MHz Intel Pentium® processor with MMX™ technology ▶ 256KB Level 2 cache ▶ 16MB RAM standard ▶ 2.1GB EIDE hard drive ▶ S3 Trio64V2 graphics ▶ McAfee Virus Scan ▶ Windows® 95 ▶ Mini-tower case ▶ 3-year limited warranty

\$899⁵⁷

CDW 95052

233MHz INTEL PENTIUM® MMX

COMPAQ

Deskpro 2000

▶ 233MHz Intel Pentium® processor with MMX™ technology ▶ 256KB Level 2 cache ▶ 16MB SDRAM standard ▶ 2.1GB EIDE hard drive ▶ Integrated S3/V2 enhanced 64-bit graphics ▶ Windows® 95 ▶ Intelligent Manageability ▶ 3-year limited warranty

\$1149⁴⁹

CDW 101308



**HEWLETT®
PACKARD**

HP Brio 8017 PC

▶ 233MHz Intel Pentium® processor with MMX™ technology ▶ 256KB Level 2 cache ▶ 32MB RAM standard ▶ 3.2GB EIDE hard drive ▶ S3 Trio64V2 graphics ▶ McAfee Virus Scan ▶ Windows® 95 ▶ Mini-tower case ▶ 3-year limited warranty

\$1137⁸⁴

CDW 95053

233MHz INTEL PENTIUM® II



**HEWLETT®
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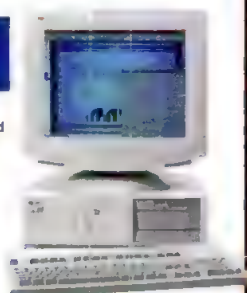


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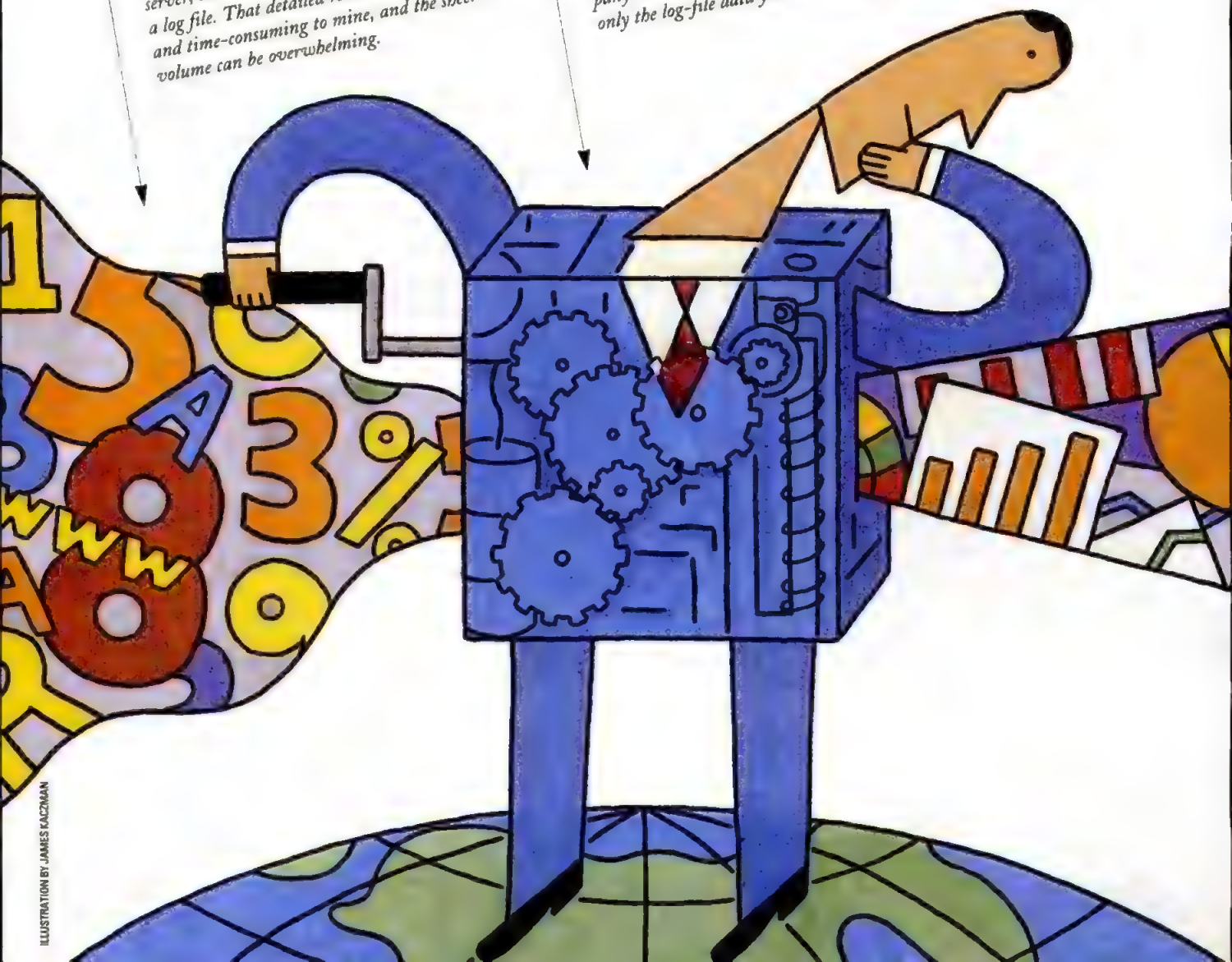
Whether you're scrambling to build a better Web site or basking in the glow of a hot one, these tools provide the inside scoop on site visitors, delivered in easy-to-understand graphical reports. **By Neil Randall**

1 CAPTURE LOG-FILE DATA

Each time you request a page from a Web server, the server keeps a record of the action in a log file. That detailed record can be difficult and time-consuming to mine, and the sheer volume can be overwhelming.

2 IMPORT AND PROCESS THE DATA

There are several approaches to analyzing log-file data. Though most products import the data into a proprietary database, a few store it in a proprietary flat file. Enterprise solutions can connect directly to your corporate databases, letting you combine your Web site data with your company data. All the products in this roundup let you set filters to ensure that only the log-file data you're interested in is processed.



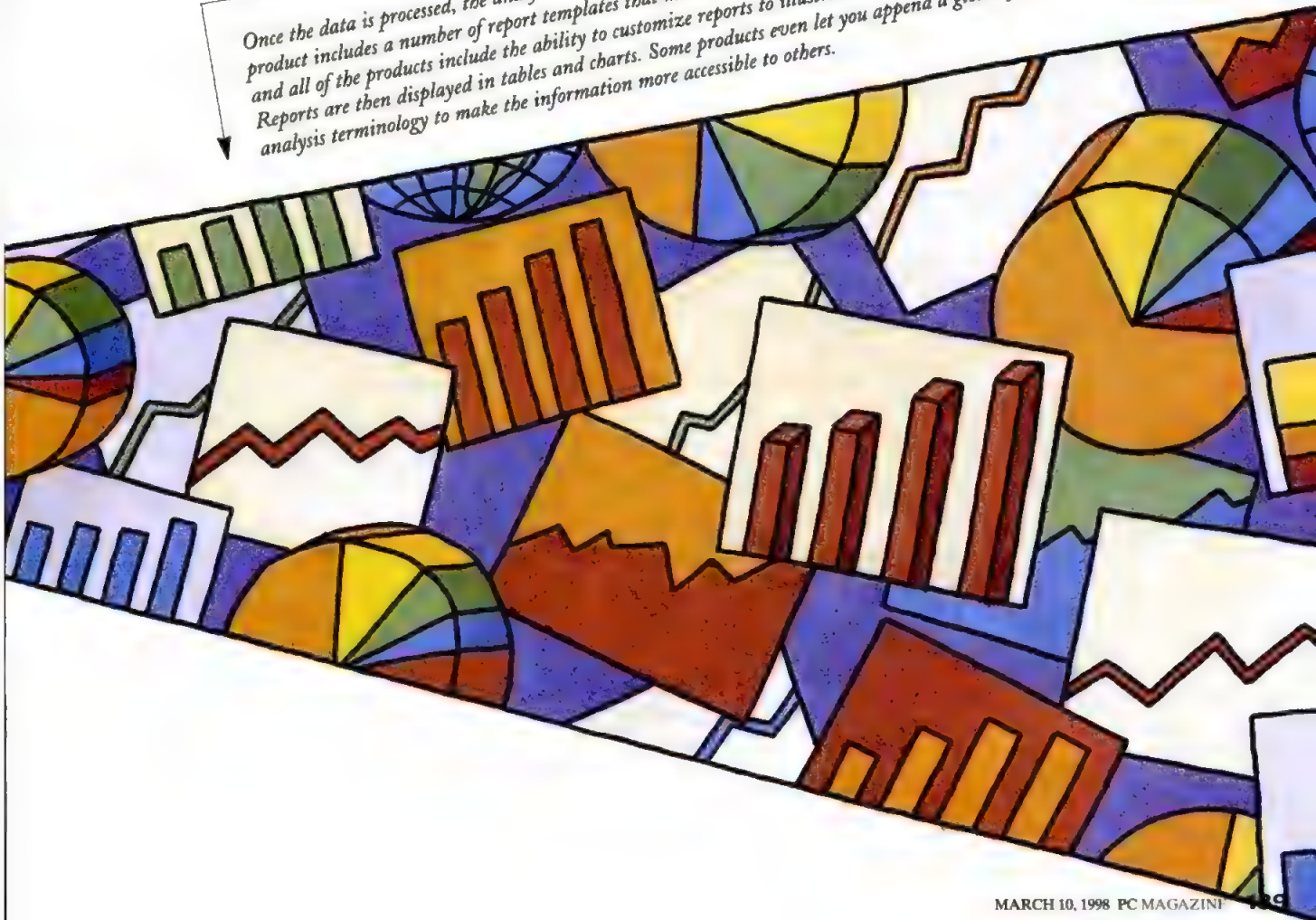
Not long ago, Web sites were considered a curiosity, or at least a novelty. Designed and implemented by one or two people on top of their regular jobs, the early sites were largely ignored by upper management. Today, the Web is increasingly the first point of contact between an organization and its clients and customers. Web sites demand full-time design and maintenance teams and multimillion-dollar budgets. Management wants to know who's visiting, what draws them, what they're looking at, and what makes them stay or leave. And companies that place ads on a site want to gauge their effectiveness. Web sites must earn their keep as business investments, just like any other marketing and information tool. That's where Web site analysis tools come in.

You may not realize that every time you visit a site, the Web server enters a valuable record of the HyperText Transport Protocol (HTTP) transaction in a log file. Although Web server log files are rich in information, the data is abbreviated and cryptic, making it difficult and time-consuming to mine. The information is also overwhelming in its sheer volume: A 1MB log file typically contains 4,000 to 5,000 page requests.

3

CREATE REPORTS WITH TABLES AND CHARTS

Once the data is processed, the analyzer creates clear, accessible reports based on the results. Each product includes a number of report templates that make it easy to spot visitor patterns and trends, and all of the products include the ability to customize reports to illustrate more esoteric results. Reports are then displayed in tables and charts. Some products even let you append a glossary of analysis terminology to make the information more accessible to others.



Web site analysis tools typically import the log-file data into a built-in database, which in turn transforms the data into readable, graphical reports that can be distributed throughout your company.

This information can be fine-tuned to meet your particular needs. A Web administrator will want to know that all clicks lead to documents and that images, multimedia files, scripts, and applets are loaded and displayed properly. A Web designer will want to know how visitors navigate the site and whether there are preferred paths or points where many visitors jump to another site.

For this roundup, we tested 11 currently shipping log-file analysis tools ranging in price from \$100 to \$3,000. When vendors offer multiple products, we tested each but focused on the product with the most comprehensive feature set. The costs of the products range widely, and we found the prices don't necessarily reflect the power or richness of feature sets.

LEAVING A TRAIL

The depth of information your Web server can capture depends on the log-file formats it supports. This is a long list: Apache extended; Lotus Domino; Microsoft IIS, IIS Extended, and IIS Virtual; NCSA Combined and Extended; Netscape Combined and Proxy; and O'Reilly Website Combined, to name a few. In addition, all servers generate log files in basic CERN/NCSA Common Log File format, a proprietary format that captures a broad range of data.

Many Web site analysis packages are compatible with all of these, however, and thus can capture a rich set of visitor intelligence, including IP address, domain name, country code, browser type and version, the time and date the request was made, the number of transactions, and the number of bytes transferred per request. The better products also provide the referrer URL, *clickstream* (the precise path taken through your site), and *clickthrough* (whether the visitor clicked through an ad).

In a nutshell, log analyzers convert log files into database files and transfer the log data into database fields. Many include built-in databases, which allow them to

save log-file data for subsequent reports. Nonetheless, four products don't work this way, instead storing an analysis as a proprietary file. This method is more time-consuming, because it requires that you run an analysis from scratch each time.

Two enterprise-level products, Microsoft Site Server (an Editors' Choice) and net.Analysis Pro NT, connect directly to a Microsoft SQL server, so if you're already running SQL, you can integrate your organization's data with your Web site data. (Site Server also connects to Microsoft Access.) Marketwave's Hit List Enterprise (\$6,995 list) takes this approach, but that product didn't fit our price filter.

Eight of these packages run on Microsoft Windows NT, and three are browser-based. Though you can run these products on the same machine as your Web server, this approach may slow performance. For the most part, each of the Windows NT-based packages provides a straightforward, wizard-based installation and adequate documentation. We found the browser-based products to be a mixed bag, however. Although they work with any Web server and are purported to run under any browser, they're difficult to install. In the end, we could only get them to run under Netscape Navigator 4.0.

Our Contributors: NEIL RANDALL is a frequent contributor to *PC Magazine*. LES FREED is a contributing editor of *PC Magazine*. TED NEEDLEMAN is a frequent contributor to *PC Magazine*. HEATH H. HEREL is a staff consultant at Walker Systems Support. ROBERT P. LIPSCHUTZ is the director of the Technology Center for Silicon Valley Internet Partners. KRISTINA DENIKE was the project leader, and TONI F. KISTNER was the associate editor in charge of this story.

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CHURNING OUT NUMBERS

Before these packages can generate tables and charts, they need to process log-file data and run reports. This process takes time. Though most products process small files quickly, all take considerable time to import large files. In our tests, files of 5MB and more took up to an hour to import.

Typical reports include the number of times specific pages were downloaded over a given time, pages downloaded most or least often in that time, trends for visitor activity at specific times of the day or days of the week, and the most common entry points into your site. All the products can illustrate rudimentary information, such as the number of hits on the home page or the most frequently downloaded files.

All the packages include preconfigured reports. NetStats Pro and SurfReport offer only one report template each, and net.Analysis Pro and NetIntellect each have more than a hundred. All the products let you build custom reports by combining report templates with *data filters* (controls that determine incoming log-file data) such as domain names and search engine referrals.

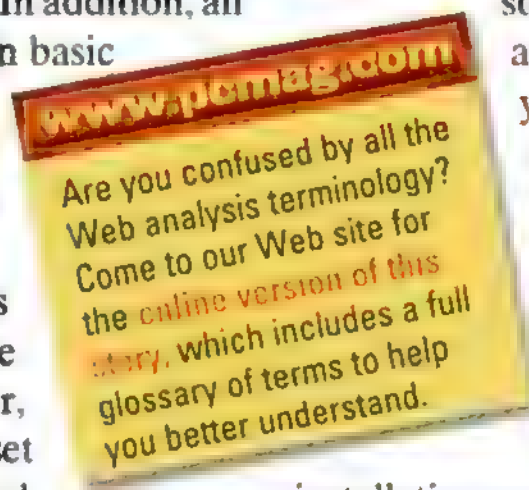
Once you've built your report, how does the product let you share it? All the products let you either export reports to Word and Excel or post them as HTML files on your server. About half provide FTP capability, and most let you e-mail a report; a few even let you compress the file.

Aquas Inc.

Bazaar Analyzer Pro

As with the other browser-based tools—NetTracker Pro and SurfReport—the ease of use and rich reporting features of Bazaar Analyzer Pro 2.0 (\$320 list for a single user) are offset by problematic installation and setup and weak export capabilities.

Oddly, Bazaar is available via download only. Once downloaded, however, the program proved difficult to install and sensitive to the browser on which we ran it. The documentation cautions against using early versions of Microsoft Internet



Explorer and Netscape Navigator; we could make it run only on Navigator 4.0.

Bazaar offers a fine selection of report templates in four filter categories (domain, contents, pages, and users) and numerous subfilters. The Profiler utility lets you create custom reports or modify existing ones, and the Visitor Path Analysis report provides useful clickstream analysis.

Bazaar provides an archiving feature that lets you store reports on the server and has useful automated features such as the ability to run reports during off-hours and e-mail reports to specific users. The program's output capabilities are curtailed by Java, however; it can export only in HTML and comma-delimited formats. And though the charts it creates are attractive, there is no way to print them except to convert Java to GIF or HTML format first. Though you can e-mail reports, the lack of a compression feature is sure to make messages unwieldy.—*Ted Needleman*

Bazaar Analyzer Pro 2.0. List price: \$320. Requires: Any browser; late version recommended. Aquas Inc., Sunnyvale, CA; 408-737-7122; www.aquas.com. Choose 531 at www.pcmag.com/infolink.

Active Concepts Pty. Ltd.

Funnel Web

On the low end of the spectrum is Funnel Web (\$199 list). Although we appreciated its easy installation and ability to analyze small files quickly, the program proved unstable, and its capabilities are limited.

Documentation is online only and contains several references to the program's Macintosh version. The program is unusually compact (2MB), and setup consists of uncompressing a single ZIP file and running the setup program. Funnel Web can read a host of log-file formats as well as log files from popular Macintosh Web servers.

Funnel Web's feature set is extremely lightweight. The product lacks a database, so you have to run each report from scratch. (It can't even remember the name or location of the last log file you accessed.) The user interface is a spartan two-button affair. The Preferences button lets you select report type and the destination of the output file and allows you to set basic filters. The Process button generates reports. Unlike the majority of the products here, Funnel Web offers no automatic scheduling or batch processing. It also

Editors' Choice

- Enterprise-level: Microsoft Site Server 2.0
- Midrange: Log Analyzer 4.0



Although nearly every product we tested has one or two notable capabilities, two manage to hit the high notes in every area and represent the touchstones

for enterprise-level and midrange log-file analysis products.

For organizations that already rely on Microsoft SQL Server or Microsoft Access, Microsoft Site Server 2.0 is an excellent solution, one that provides seamless integration between your company data and your Web site data. It offers unique log-file import features, including the ability to deduce a referring site's URL even with incomplete link information, a strong array of built-in reports and filters, and top-notch support for multiple servers. And at \$1,499 list, Microsoft Site Server costs considerably less than other enterprise solutions such as net.Analysis

lacks an HTTP or FTP file-transfer facility, requiring local or LAN access to your Web server. Funnel Web took only a few seconds to analyze our 130K file, though on files over 1MB it was prone to crashes.

Report details are skeletal, and Funnel Web's output and distribution options are sparse. It creates reports in HTML, with simple charts created as GIF files. There are no export capabilities, aside from the ability to cut and paste the HTML file into



Funnel Web's two-button main window is as simple as they come.

another program or e-mail. The master report page contains a nice feature, though: a clickable table of contents that links to major sections of the report.—*Les Freed*

Pro NT (\$2,495 list) and Hit List Enterprise, which topped out of our price filter.

As you'll see in the reviews, mid-range log analyzers run the gamut in price, power, and capability. If you don't need the power of a SQL solution, WebTrends' Log Analyzer 4.0 does the best job across all areas for an excellent price (\$299 list). It provides a wealth of attractive reports, click-through analysis for ads, and unlimited free technical support. Extensive filtering options include the ability to impose multiple filter sets on the same log file, and impressive speed enhancers set the product apart from the others during log-file import and report processing.

Funnel Web 1.0.5. List price: \$199. Requires: Microsoft Windows 95 or Windows NT, 486-based PC or better, 8MB RAM, 5MB disk space, 8-bit video. Active Concepts Pty. Ltd., Carlton, Victoria, Australia; 613-9344-9295; www.activeconcepts.com. Choose 532 at www.pcmag.com/infolink.

Marketwave Corp.

Hit List Pro

If you need extra power and advanced features but don't want to commit to an enterprise solution, consider Hit List Pro 3.5 (\$995 list). It's easy to use and features unique search capabilities and granular control over reporting. But as with the other midrange solutions, such thorough analysis puts a drain on performance.

Well-considered default choices had us up and running easily, but the heavy use of wizards made the installation somewhat time-consuming. Users who prefer fine configuration control will appreciate the extensive customization options.

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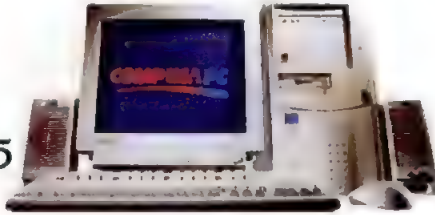
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NETWORKING

Web Site Analysis Tools

The unique QuickList feature lets you batch-analyze logs from multiple servers, and a scheduling feature lets you run automated reports. But importing log files was notably slower than with Log Analyzer, especially during the initial file conversion.

Hit List features unique capabilities that provide visitor-search information. Search Engine Reporting lets you view the keywords a visitor typed into an Internet search engine to find your site, and the Directory Keyword Reporting feature creates a database of the information visitors enter into any search engines on your site.

The program includes a wide variety of predefined (though easy-to-customize) reports in tabular format. You can add charts as well as text explanations of the analysis. It lets you compress reports into ZIP and GZIP file formats, send reports via e-mail, and export reports in Word, Excel, ASCII, and HTML formats.

Hit List Pro is just one product in Marketwave's line. Hit List Pro Intranet Version (\$1,495 list) let you track which sites your employees are visiting. (For other Marketwave products, see the sidebars "Watching Web Site Traffic Go By" and "The Under-\$100 Crowd.")—*TN*

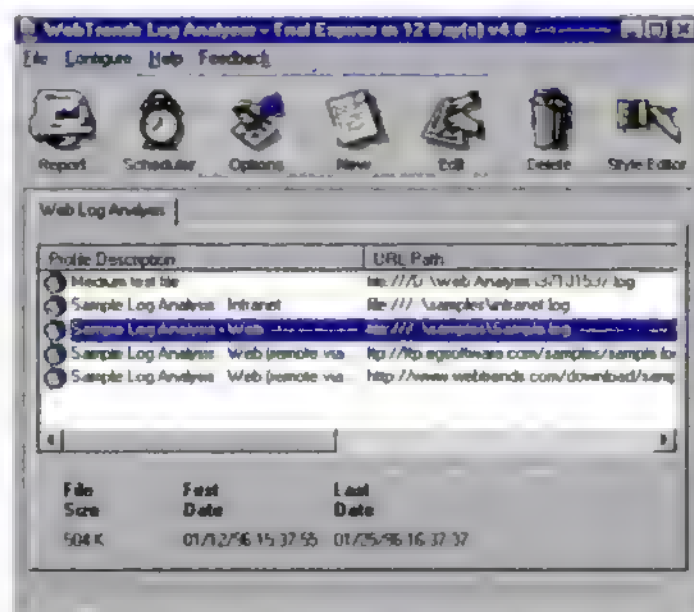
Hit List Pro 3.5. List price: \$995. Requires: Microsoft Windows 95 or Windows NT 3.51 or later, Pentium/90-based PC or better, 16MB RAM, 30MB disk space. Marketwave Corp., Seattle; 800-521-8176, 206-682-6801; www.marketwave.com. Choose 533 at www.pcmag.com/infolink.

WebTrends Corp.

Log Analyzer



WebTrends (formerly e.g. Software) is a pioneer in log-file analysis software, and its experience is evident in Log Analyzer 4.0 (\$299 list). Unique speed enhancements in this version add to a product already teeming with rich capabilities, earning it an Editors' Choice.



Log Analyzer's attractive main menu displays a list of frequently used log files.

Setup was one of the easiest we experienced, taking only 5 minutes. Unlike other products, Log Analyzer recognized our Web server and located its log files automatically. There are detailed print documentation and useful sample log files.

LogAnalyzer's fine use of wizards makes importing log files intuitive. Files can be copied from your Web server or

downloaded via HTTP or FTP. Extensive filtering options let you run reports on criteria such as file type, requesting domain name, and referring URL. A notable feature lets you impose multiple filter sets on the same log file, saving time while adding extra flexibility. Log Analyzer gives you more than 40 predefined report templates and custom templates, and it includes a built-in scheduler to automate reports.

With a sharp eye on speed, the FastTrends feature caches results for frequently run log profiles to speed compilation of subsequent reports. A sampling option lets you stop an analysis midstream and generate a report on the data already processed.

Log Analyzer's reports are attractive and easy to understand. You can create tables and charts, and a style editor lets you apply color, font, and sorting options from a set of predefined styles that are also customizable. You can even append a custom glossary with analysis terminology.

The export options cover all the bases. Log Analyzer can generate reports in plain text, Microsoft Word and Excel, and HTML formats. This gives you the flexibility to import reports into existing documents, distribute them via e-mail, or output them to a Web server via FTP.—*LF*

Log Analyzer 4.0. List price: \$299. Requires: Microsoft Windows 95 or Windows NT 4.0, 486-based PC, 8MB RAM (16MB recommended), 20MB disk space. WebTrends Corp., Portland, OR; 503-294-7025, www.webtrends.com. Choose 534 at www.pcmag.com/infolink.

SUITABILITY TO TASK

	Bazaar Analyzer Pro 2.0	Funnel Web 1.0.5	Hit List Pro 3.5	Log Analyzer 4.0	Microsoft Site Server 2.0	netAnalysis Pro NT 3.1
POWER						
Installation	Fair	Fair	Good	Good	Excellent	Good
Importing log files	Good	Poor	Good	Excellent	Excellent	Good
Generating reports	Good	Poor	Good	Good	Excellent	Good
Analysis aids	Fair	Fair	Good	Good	Excellent	Excellent
EASE						
Installation	Fair	Poor	Good	Good	Good	Poor
Importing log files	Good	Fair	Good	Excellent	Fair	Fair
Generating reports	Good	Fair	Good	Excellent	Good	Good
Analysis aids	Good	Fair	Good	Excellent	Good	Fair

For **Installation** we evaluate software setup and configuration. We look for clear, accessible documentation aimed at Webmasters. A package should be compatible with a wide variety of log file formats. The most flexible packages use built-in databases and also work with a range of other databases.

Importing log files includes the scheduling of multiple, automatic log-analysis jobs. When the package imports a log file, the data should be available for use in multiple reports without rescanning. We look for reasonable speed with a variety of file speeds, and any time-saving summarization options.

Generating reports refers to the inclusion of useful filters such as reverse DNS lookup, ad tracking, and trends over multiple days. We reward packages that can track the *clickstream*—a guest's path through the site. We are especially interested in the quality and variety of report

Microsoft Corp.

Microsoft Site Server

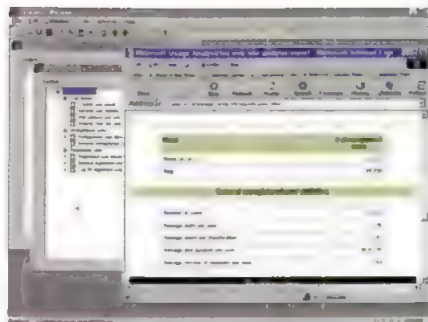


Unlike the other products in this roundup, Microsoft Site Server 2.0 (\$1,499 list) is a Web site suite; we tested the Usage Analyst tool only. Site Server, one of two enterprise-level products we tested, is a powerful and comprehensive analysis solution geared to data specialists who use Microsoft SQL Server or Microsoft Access. It earns an Editors' Choice.

Setup was painless. The product integrates with an Access or SQL Server 6.5 database, giving you the power to access multiple databases across data servers and sites—capabilities you won't find in other products in this roundup. But configuring the data import paths from these sources is difficult and time-consuming. Although we found it easier to configure than net.Analysis Pro NT, Site Server would benefit from additional wizards.

Unique data-import functionality includes the ability to exclude specific hosts and file types and to deduce the referring site even with incomplete link information (which occurs when visitors come from a cached page). The Log File Manager lets you combine multiple files of any major log-file type into a single import, and it gives you a handy tabular view of the history of each import action.

Site Server processed files more slowly than other products, but that is justifi-



Microsoft Site Server can display information in several formats, including HTML.

able given the degree of granularity in the reports. Import times varied from extremely fast (a matter of seconds) for log files under 2MB to unexpectedly slow (up to several hours) for files exceeding 50MB. You can also extract deeper information, such as HTML titles, reverse DNS lookups, and Whois lookups of IP addresses; you can even exclude hits from Web spiders.

When you're ready to create reports, you'll find the Analysis Module has powerful capabilities. The provided report templates aren't customizable, but the selection is extensive, and a wide range of filters give you precise control over how the information is presented. Reports are created in the form of attractive tables and graphs that include concise explanations of how to interpret the data. Usage Analyst can display reports as HTML files, or you can export a report to Microsoft Word or Excel.—NR

Microsoft Site Server 2.0. List price: \$1,499. Requires: Microsoft Windows NT 4.0, IIS 3.0, Pentium/133- or DEC Alpha-based PC, 64MB RAM, 600MB disk space, Microsoft Corp., Redmond, WA; 800-426-9400, 425-882-8080; www.microsoft.com/siteserver. Choose 535 at www.pcmag.com/infolink.

net.Genesis Corp.

net.Analysis Pro NT

Like Microsoft Site Server, net.Analysis Pro NT 3.1 (\$2,495 list) is an enterprise solution that integrates with Microsoft SQL Server. Although it is one of the most powerful tools we tested, we found getting net.Analysis Pro to work with SQL quite difficult. And although the program's abundance of reporting options and filters is unmatched, the sheer volume can be overwhelming.

The product works in conjunction with Microsoft SQL Server 6.5 (not included). Setup is not trivial: SQL Server needs to be configured just so, but the instructions are not in the standard documentation. (We eventually found them in the release notes.) net.Analysis Pro has two primary components, net.Analysis Engine and net.Analysis Reporter. Oddly, you install Engine on the same system as SQL Server and Reporter on individual clients (licensing is by Windows NT domain). Site Server was much easier to install.

Log file data is kept in *data stores*—databases that can include data from multiple log files across multiple sites. You can configure exclusion filters to select only the data you need. Importing large files (over 50MB) took an average of 1 to 2 hours, but we were surprised at how slowly the program imported small files also. Once imported, though, the files become part of the data store, and as such are quick to access.

net.Analysis Pro packs extremely powerful reporting capabilities. More than 100 predefined reports and 30 predefined filters let you view data practically any way imaginable, punctuated by the ability to create custom filters. Unfortunately, such power is diluted by weak usability. We would have appreciated stronger guidance in configuring reports.

Where net.Analysis Pro shines is in publishing and sharing reports. The prod-

NetIntelect 3.0	NetStats Pro	NetTracker Pro 3.0	SurfReport 2.16	Web Tracker 2.1
Good	Poor	Good	Fair	Good
Excellent	Fair	Fair	Poor	Excellent
Good	Poor	Good	Poor	Good
Good	Fair	Fair	Fair	Good
Excellent	Fair	Poor	Poor	Excellent
Good	Fair	Good	Fair	Good
Good	Good	Good	Fair	Fair
Good	Fair	Good	Fair	Fair

templates accessible to non-IS personnel. Users should be able to create and save custom templates.

Analysis aids refers to tools that make the data more readable and easier to understand. Reports should include graphical data summaries. Text descriptions of data in the

charts are also helpful. Some packages also offer data mining, which incorporates data from other sources into reports. When a report is compiled, we look for the software's ability to export data into spreadsheets, word processors, and other databases.

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uct includes a small intranet site called ReportSite. Users click on ReportSite's calendar-based interface to access daily, weekly, or monthly reports. It even includes a subscription utility that lets users select specific reports to receive via e-mail. The reports display attractive text tables and graphical charts on one page; we would have liked more detailed explanations of the results, though. A scheduling

feature lets you e-mail reports as Microsoft Word or Excel attachments.—*NR*
net.Analysis Pro NT 3.1. List price: \$2,495. Requires: Microsoft Windows NT 4.0 or later, Microsoft SQL Server 6.5, Pentium/166-based PC or better, 64MB RAM, 250MB disk space. net.Genesis Corp., Cambridge, MA; 800-982-6351, 617-577-9800; www.netgen.com. Choose 536 at www.pcmag.com/infolink.

WebManage Technologies Inc.

NetIntellect

NetIntellect 3.1 (\$199 list) is a strong package that's particularly appropriate as a company's first analysis tool. It's easy to set up and use but still packs enough power and features to provide meaningful information. NetIntellect reads a variety of log-file formats and automatically decompresses ZIP and GZIP files.

Watching Web Site Traffic Go By

Three high-end Web site analyzers—Andromedia's Aria, Marketwave's Hit List Live, and Accrue's Insight—are geared to people who need capabilities beyond those offered by the products in the main roundup: automated real-time analysis, elaborate data mining, and enhanced ability to monitor multiple servers.

Unlike log-file analyzers, Hit List Live and Insight monitors reside on the network and analyze packets of information in real time: Such analysis is called *packet sniffing*. The products gauge performance according to how fast a server responds to requests. Because the products work independent of your Web server, there is no performance hit. But they can't analyze packets encrypted with Secure Sockets Layer (SSL), though each company plans to remedy this lack in upcoming versions.

Aria 2.0 (Standard, \$9,895 list; Gold, \$18,895) offers another approach: It uses agents to analyze real-time traffic right on the Web server. Unlike packet sniffers, Aria can analyze SSL traffic but is dependent on the server and NOS. Aria generates real-time reports with plenty of information, but it lacks the tools necessary for deeper analysis. The Aria architecture consists of three parts: the monitor, the recorder, and the reporter. The monitor takes the form of server agents, which intercept traffic from the Web server; the recorder receives and processes the data; and the reporter presents the information in charts.

The user interface is not as simple

as those of Hit List Live and Insight, and you can't customize reports. Aria is used with applications that utilize real-time monitoring capabilities, such as personalization engines, to give users information based on their behavior. (Andromedia Inc., San Francisco; 415-278-0703; www.andromedia.com. Choose 543 at www.pcmag.com/infolink.)

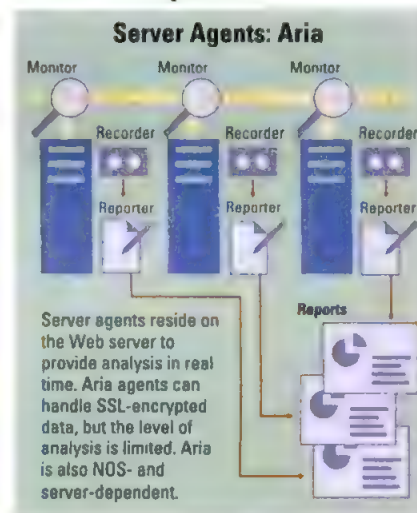
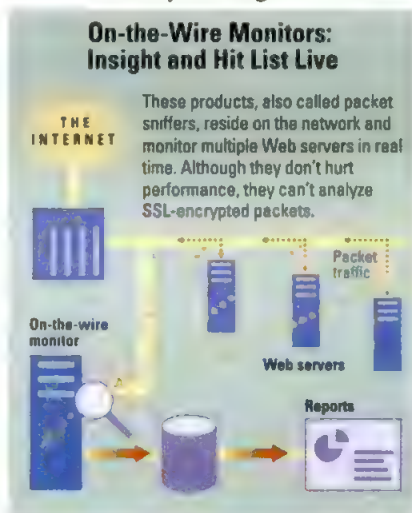
Hit List Live 3.5 (\$15,995 list) provides real-time network monitoring and advanced data mining with the ability to export the information to other databases. Unlike the other companies here, however, Marketwave also lets you employ its log-file analysis tools with its on-the-wire product.

Hit List Live can handle multiple sites, including those on off-site Web servers, but the analyzer must sit on the same network segment as the Web server it monitors. Hit List Live touts the ability to integrate with

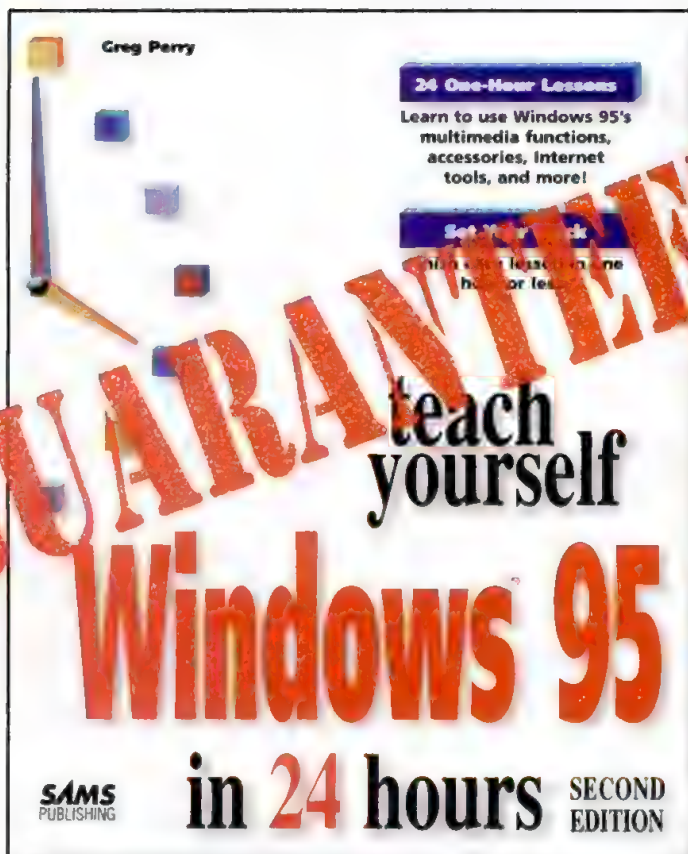
other databases—something Insight cannot do. You can identify users based on information in other databases and integrate this data into reports. (Marketwave Corp., Seattle; 800-521-8176, 206-682-6801; www.marketwave.com. Choose 533 at www.pcmag.com/infolink.)

Insight 1.1 (\$10,000 list and up) has long been the standard network-based Web site monitor for complex sites. The product is especially good at tracking clickstreams through a multiserver site. If you have multiple hyperlinked Web servers, Insight can give you a consolidated picture of how users flow through. The product is most effective at analyzing large quantities of data, and the built-in data-mining ability provides in-depth analysis. (Accrue Software Inc., Sunnyvale, CA; 888-422-2783, 408-542-8900; www.accrue.com. Choose 546 at www.pcmag.com/infolink.)

—Robert P. Lipschutz



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SUMMARY OF FEATURES

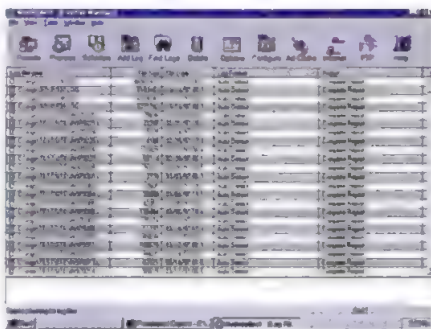
Web Site Analysis Tools



■ YES ■ NO	Nazan Analyzer Pro 2.0	Funnel Web 1.0.5	Hit List Pro 3.5	Log Analyzer 4.0	Microsoft Site Server 2.0	netAnalysis Pro NT 3.1	NetIntellect 3.0	NetStats Pro 3.0
List price	\$320.00 (single user)	\$199.95	\$995.00	\$299.00	\$1,499.00	\$2,495.00	\$199.00	\$129.00
Platforms supported	Windows NT, AIX, BSD, BSDI, HP-UX, Linux, Solaris	Windows 95, NT; FreeBSD, HP-UX, Irix, Linux, Solaris	Windows 95, NT	Windows 95, NT	Windows 95, NT	Windows NT, Solaris	Windows 95, NT	Windows 95, NT
Log files supported	Flexible (user-defined), Microsoft Internet Information Server (all extensions), NCSA Combined, NCSA Common	Apache, Microsoft Internet Information Server, Netscape, NCSA Common, NCSA Extended, Purveyor, WebStar	All major log file formats	All major log file formats	All major log file formats	All major log file formats	All major log file formats	Common Log File
Installation and Administration								
Wizard-based installation	■	■	■	■	■	■	■	■
Custom installations available	■	■	■	■	■	■	■	■
Built-in database software	■	■	■	■	■	■	■	■
Works without third-party database software	■	■	■	■	■	■	■	■
ODBC database support	■	■	■	■	■	■	■	■
Supports remote administration	■	■ (Unix version only)	■	■	■	■	■	■
Report Generation								
User can schedule unattended reports	■	■	■	■	■	■	■	■
User can apply multiple filters for a report	■	■	■	■	■	■	■	■
User can create reports on virtual Web servers	■	■	■	■	■	■	■	■
User can report across multiple log files	■	■	■	■	■	■	■	■
Predefined report templates	20	10	29	32	29	142	100	1
User can create report templates	■	■	■	■	■	■	■	■
User can save reports in MS Word format	■	■	■	■	■	■	■	■
User can create a batch job of log files	■	■	■	■	■	■	■	■
User can merge reports	■	■	■	■	■	■	■	■
Provides trends over the week/month/year	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
User can map peaks over a day/week/month	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Filtering								
User can create own filter groupings	■	■	■	■	■	■	■	■
User can run a filter on a portion of a log	■	■	■	■	■	■	■	■
Tracks information from cookies	■	■	■	■	■	■	■	■
Uses its own cookie	■	■	■	■	■	■	■	■
Supports tracking based on:								
User/domain name	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Domain type	■	■	■	■	■	■	■	■
File type/name/size	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Entry/exit pages	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Ad banner	■	■	■	■	■	■	■	■
Time spent per page	■	■	■	■	■	■	■	■
Average time per page	■	■	■	■	■	■	■	■
Requests	■	■	■	■	■	■	■	■
Referring page	■	■	■	■	■	■	■	■
Search strings	■	■	■	■	■	■	■	■
Analysis Aids								
Text descriptions of results	■	■	■	■	■	■	■	■
Offers charting/graphing options	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Performs reverse DNS lookups	■	■	■	■	■	■	■	■
User can automate:								
E-mail distribution	■	■	■	■	■	■	■	■
File compression	■	■	■	■	■	■	■	■
FTP distribution	■	■	■	■	■	■	■	■
User can link/output report to a database	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User can add logos/graphics/charts to report	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Clickstream/real-time site analysis	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■

The wizard-based setup was a snap. The installation software provides default settings for all options and makes specifying directories and components easy. The included user manual is well written and detailed but marred by the lack of an index.

NetIntellect includes many features that speed analysis operations. A built-in database lets you generate multiple reports and queries without having to reimport the log. Fast Processing restricts the analyses to the top 1,000 returns for a particular query, such as Most Requested Pages. Complete analyses, called Extended Processing, run quickly because the program compresses files in the database. The Log File Manager makes simple



NetIntellect's Log File Manager makes it easy to track log processing.

work of selecting logs for processing and configuring batch files. You can schedule reports for processing during off-hours and distribute them via e-mail in HTML or Microsoft Word format.

NetIntellect uses reports and queries to provide data analysis. The hierarchical tree in the left pane provides a list of standard queries and reports. You simply click on an entry to perform a query such as "Traffic by Day" and run a report. There are a comprehensive array of default reports, and customizing these or creating custom reports is done through a series of straightforward dialog boxes.

You can generate reports either through the query pane or by clicking on the Report icon on the toolbar. You can view query and report information in the default list display or in grid or table format (better for large quantities of data). Reports can be displayed in HTML or saved in Word format and compressed for e-mailing. Oddly, NetIntellect can not export reports to Excel.—TN

NetIntellect 3.1. List price: \$199. Requires: Microsoft Windows 95, Windows NT 3.51 or higher, or Unix, 486/50-based PC or better, 16MB RAM, 10MB disk space, WebManage Technologies Inc., Nashua, NH; 603-594-9226; www.webmanage.com. Choose 537 at www.pcmag.com/infolink.

Insanely Great Software

NetStats Pro

At the low end of the price range in this group, NetStats Pro (\$129 list) presents reports in well-organized charts and tables. On the other hand, the product supports only the common log format (CLF), poor online-only documentation, and limited filtering. If your needs are modest, NetStats Pro might suffice, but you should also consider the products discussed in the sidebar "The Under-\$100 Crowd."

The wizard-based installation was easy, as was importing the CLF files, either by copying them manually into the database or via FTP transfers. But analyzing multiple log files required us to compile the data into a single database table. We prefer the approach of Web Tracker, which conducts queries across multiple log files without combining the data.

Unlike the comparably priced Funnel Web, NetStats Pro includes its own database. It can report the hour, day, week, and month for each entry. Though you can use a third-party utility to convert other log-file formats to CLF, CLF won't provide critical information on the user agent and referrer URL.

The product's user interface is simple and well organized. The tabular display presents the information clearly, but we would have appreciated some flexibility in sorting and ordering the fields. (You can sort by data and time only.) You can generate reports from any of 15 query templates and impose filters to extract more detailed information. But the filters are more effective for numeric data, such as dates and times, than for text. For example, you can't filter graphics files by file extension, because the mechanism lets you place the filter only at the beginning of the filename.

NetStats Pro displays data in HTML tables and charts as GIF files. You can print these using a standard browser, but there's no way to export tables to a spreadsheet or database.—RPL



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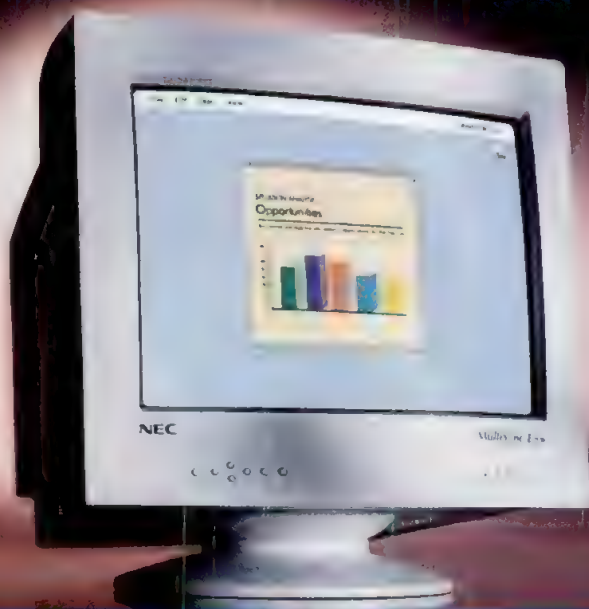
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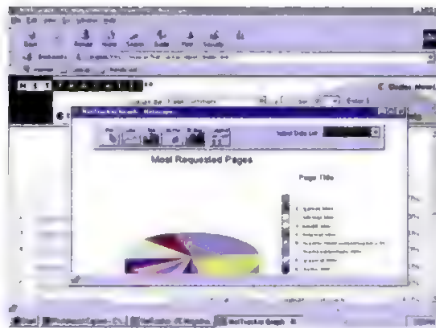
NEC Technologies

Web Site Analysis Tools

NetStats Pro. List price: \$129. Requires: Microsoft Windows 95 or Windows NT 4.0, 486-based PC or better, 4MB disk space. Insanely Great Software, Boston; 617-266-1630; www.igsnet.com. Choose 538 at www.pcmag.com/infolink.

Sane Solutions LLC NetTracker Pro

The Java-based NetTracker Pro 3.0 (\$495 list) has a mixed set of capabilities that some users will find suitable. Because the program runs in a browser, it's flexible, compatible with many Web servers, and able to analyze an impressive list of log-file formats. However, setup was difficult, the database engine was slower than average, and output capabilities are limited.



NetTracker Pro can generate beautiful 3-D Java graphs, but it can't print them.

The package includes a user guide in Portable Document Format on the CD-ROM, but it doesn't include Adobe Acrobat Reader for reading and printing the user guide files.

Importing log files into the database

was particularly slow. But the program's ability to generate reports quickly makes up for some of the lag, and a generous assortment of filters make customizing reports easy. Results are presented in tabular format; for more detail, simply click on the links. NetTracker Pro features excellent export capabilities, saving to Microsoft Word, Excel, or Access via a handy Export button on the mail toolbar. NetTracker Pro can also mail HTML reports and charts. And though the charts it creates are superior in design to many of those produced by the Windows-based packages, you have to settle for distributing them electronically.

Sane Solutions also offers a plain version, NetTracker 3.0 (\$295 list), which lacks features such as user-created report

Web Site Analysis for Hire

If you don't want to manage Web site analysis tools or your site is hosted by a third party, online services such as Keynote Perspective Web Edition, Nielsen I/PRO NetLine, and RelevantKnowledge's Site Report and Web Report will do the analysis for you.

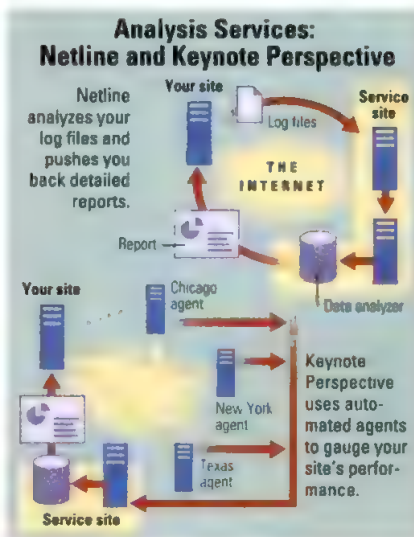
With a focus on site performance, **Keynote Perspective Web Edition** (\$295 per URL per month) uses automated agents to access your site at 15-minute intervals throughout the day. The agents, stationed in major cities, measure the time required to perform functions and send that information to Keynote's server. This lets you access real-time performance measurements of your Web site and provides a quick way to respond to server problems.

But the browser-accessible data is available for only 24 hours, making it imperative that you get the data quickly. The client version, **Keynote Perspective Professional Edition**, provides unlimited access to performance data. (Keynote Systems Inc., San Mateo, CA; 650-524-3000; www.keynote.com. Choose 547 at www.pcmag.com/infolink.)

Nielsen I/PRO NetLine (\$750 per month for up to 250,000 file requests per day) takes raw log files, processes them into reports, and pushes them to

your client. Reports are similar to those of the products in the main roundup and include such advanced features as clickstream analysis.

NetLine requires that you install a proprietary client to receive the reports. We found the interface simple to use, and the reports combine numerical data with clear, colorful graphs. You can also save reports in Microsoft Excel format for further analysis. (Internet Profiles Corp., San Francisco; 415-975-5800; www.ipro.com. Choose 549 at www.pcmag.com/infolink.)



RelevantKnowledge takes yet another approach, with two products based on the census model used in other mass media. The company collects core data from a user sampling representative of the Web. It compiles information such as clickstreams and page impressions to provide national audience projections for a Web site, broken down into demographic groups.

RelevantKnowledge offers two services, **Site Report** (\$48,000 per year, plus \$5,000 for additional sites) and **Web Report** (\$60,000 per year). Site Report provides detailed demographics on each section of your site. The Java-based report lets you perform cross-tabulations or customize the report to meet your needs. You can use this to make an accurate determination of exactly who visits your site and what visitors do there.

Web Report provides a demographic breakdown of the top 150 Web sites, which you can use to perform comparative analyses of your own site against some of the largest on the Web. (RelevantKnowledge Inc., Atlanta, GA; 404-224-2400; www.relevantknowledge.com. Choose 553 at www.pcmag.com/infolink.)—Heath H. Herel



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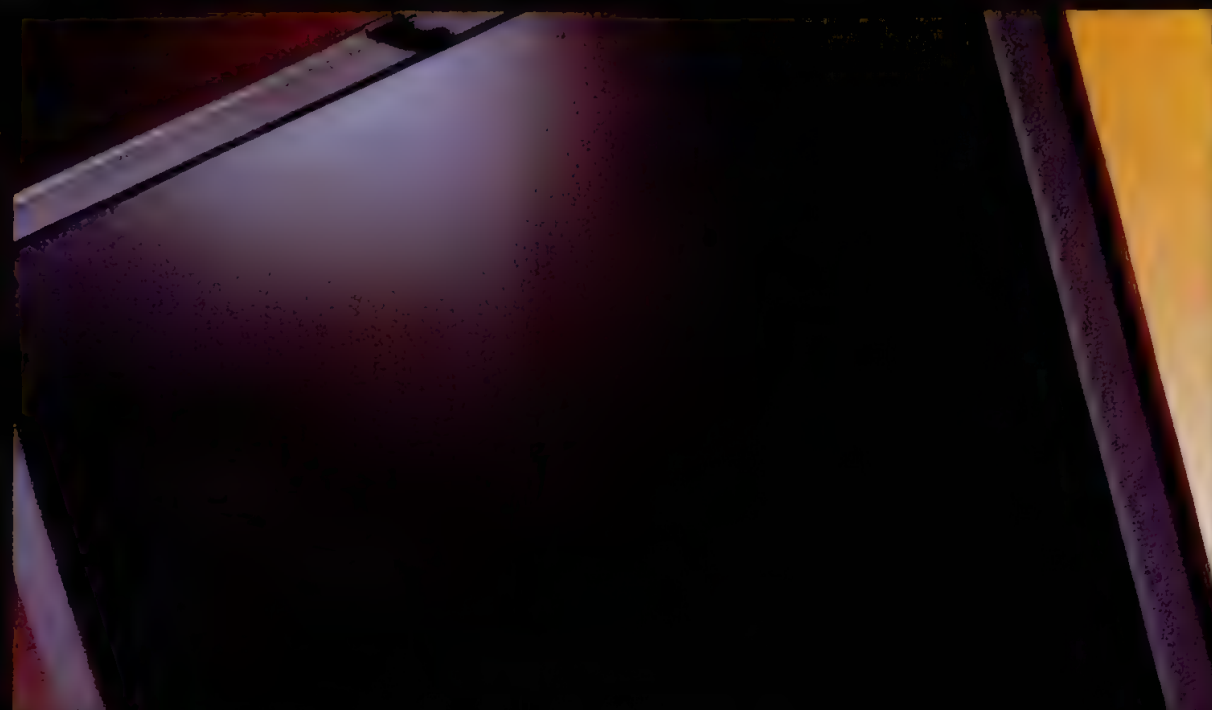


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templates and ad-banner tracking. NetTracker Enterprise 3.0 (\$995 for a five-Web-site license) lets you track multiple sites residing on the same server and features serverwide reports for analyzing intranet activity.—*TN*

NetTracker Pro 3.0. List price: \$495. Requires: Microsoft Windows 95, Windows NT, or Unix server; Pentium-based PC; 32MB RAM. Sane Solutions LLC, Wickford, RI; 800-407-3570, 401-295-4809; www.sane.com. Choose 539 at www.pcmag.com/infolink.

Bien Logic Inc.

SurfReport

A browser-based tool built in PERL and C, SurfReport 2.1 (\$695 list) has a simple, forms-oriented user interface that makes it fairly easy to use. But it lacks the flexibility and power of other products in this roundup. There are only five filters, and the reports appear as stark-looking charts. In testing, SurfReport ran only under Netscape Navigator 4.0, and launching charts caused our system to crash.

Although the package includes a printed manual and documentation on CD-ROM, the material lacks an index and

detailed troubleshooting information. The installation places a PERL interpreter in the System directory and updates CGI file properties. We were unable to get the program to run under Microsoft Internet Explorer despite installing it on several different Windows NT servers and getting help from technical support.

SurfReport's limited capabilities makes running reports cumbersome and time-consuming. It reads only Common, Combined, and IIS log formats. And because it lacks a built-in database or connections to an external database, you must configure each report from scratch. Creating batch jobs was relatively easy, though: We set up the program to analyze a given directory, then copied the desired files to that directory. There is no built-in scheduling.

Creating reports is straightforward. Although SurfReport lets you select report and filter options from a single screen, there is no facility for saving report configurations. SurfReport automatically embeds charts in the reports in some categories (such as site visitors), where they're displayed as small chart icons on the report screens. You can display the charts and modify them by

clicking their icons, but this process caused our system to crash on several occasions.

Export options include the ability to e-mail reports in HTML format or as Microsoft Excel attachments and to move data to a spreadsheet. But other products, such as Hit List Pro and NetIntellect, also let you export reports to Microsoft Access and Word formats.—*TN*

SurfReport 2.1. List price: \$695. Requires: Any Microsoft Windows NT or Unix server. Bien Logic Inc., La Jolla, CA; 619-551-4888; <http://bienlogic.com>. Choose 540 at www.pcmag.com/infolink.

Cambridge Quality Management Inc.

Web Tracker

Though the Windows 3.x user interface colored our first impression, the strong capabilities of Web Tracker 2.1 (\$495 list) quickly won us over. This powerful log-analysis tool makes quick and easy work of extracting information, even from large log files. The product is targeted at power users who want full control over their data.

Setup was straightforward, and though the package lacks written documentation,

The Madison Avenue Angle

Just as advertising has become an integral part of other media, advertising on the Internet is gaining momentum. The ad community is well versed in delivering focused messages to traditional media, but bringing that same level of focus to the Web has been a considerable challenge. But help is only a click away with Internet advertising products and services.

Accipiter AdManager 2.0, DoubleClick DART and the DoubleClick Network, Focalink MarketMatch 2.0, and NetGravity AdServer 3.0 provide assistance to advertising agencies in placing Web ads. Each product has a slightly different angle on ad management. Some of the products require you to run a Web server; they run in the background and tie into the vendor's host as needed. Others host the entire service remotely.

These products help advertisers locate sites that best represent their audience. This is done with the creation of site and user-profile information: Web administrators submit core data on a site's traffic, content, and users; the service stores this information in a central database. Advertisers can then search the database to determine which sites best match their target audiences.

Packages such as AdManager and AdServer offer extensive inventory management capabilities to complement the advertisement management features. A wealth of reporting tools

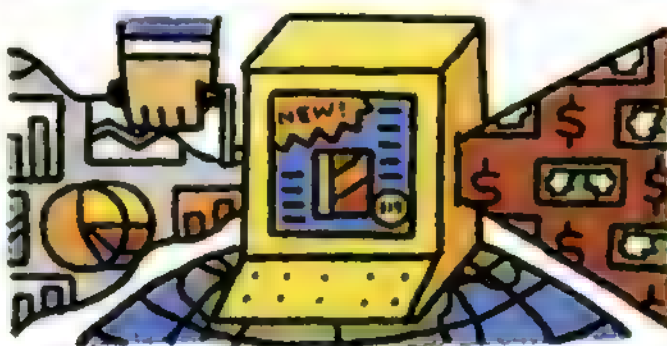
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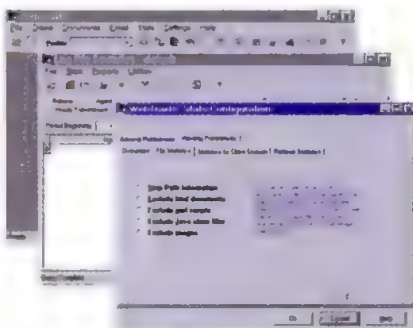
Until you know exactly what you need, you shouldn't spend a lot of money on a Web analysis tool.

Here are several programs costing less than \$100 that can get you started in Web site analysis and help you determine what other capabilities you really need. These low-end analyzers are typically restricted to reading common log file (CLF) file types and perhaps a few others. And they lack the flexibility and power of the products reviewed in the main story.

Marketwave's **Hit List Standard** is the free version of Hit List Professional and is worth considering before you spend your money. The program accepts a wide range of file types, including IIS 4.0 and Lotus Domino. It provides more than a dozen pre-configured reports and a scheduler that lets you distribute them automatically via e-mail. It even supports multiple servers. (Marketwave Corp., Seattle; 800-521-8176, 206-682-6801; www.marketwave.com. Choose 533 at www.pcmag.com/infolink.)

Microsoft Site Server Express (free) is included with IIS 4.0 and is a stripped-down version of Microsoft

Site Server, Standard Edition. It includes a useful visual site management tool and a log-file analysis tool. Site Server Express lets you import only NCSA Common and IIS log-file formats, and there are only nine reports available. (Microsoft



WebTraxPC's statistic configuration dialog lets you exclude specific information about client domains, document types, and referrer domains.

Corp., Redmond, WA; 800-426-9400; www.microsoft.com/iis. Choose 535 at www.pcmag.com/infolink.)

PressVu 1.1 (\$55 list) imports NSCA common and IIS standard log files into an Xbase-compatible database that accepts queries against the data through any Xbase query language. It includes

three standard reports, and imports are relatively speedy. (Academicus Press, Fort Lauderdale, FL; 954-760-9102; www.academicus.com. Choose 550 at www.pcmag.com/infolink.)

Know-It's **WebTrak 1.6** (\$49 list) reads only common log files, but it does an extensive job with them at a good speed with small files. You can get text or graphic reports for top users, top countries, and activity, by date and day of the week. It can also perform reverse DNS lookups and can filter imports by file type and IP address. (Know-It, Carrollton, TX; 972-492-9838; www.know-it.com/webtrak.htm. Choose 554 at www.pcmag.com/infolink.)

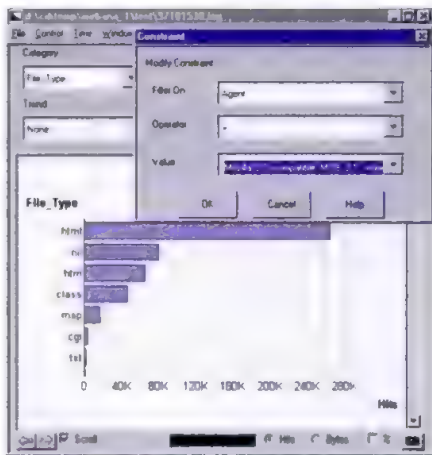
John C. Taylor's **WebTraxPC 2.05** (\$69 list) gives you statistics ranging from simple hourly and daily hits to the most accessed files. It reports user agent and referrer statistics, and charts can include lines, pies, and bars. The program is limited to common log file formats, but it imports these to its database quickly. (John C. Taylor, www.jt.w1.com/webtrax. Choose 555 at www.pcmag.com/infolink.)—NR

the detailed online help was very good. Web Tracker is flexible and accepts a broad range of log-file formats.

Web Tracker also includes notable performance enhancements. To speed the importation of large log files, it gives you the option of importing only a sample (every tenth row in a file, for instance), which made importing our 80MB log file surprisingly fast. The product also uses "query-optimized" binary formats instead of a database to store data, a method that also speeds the conversion process.

The product's reporting capabilities are robust. It generates reports based on categories, which means it can filter on more granular data than just filename and referrer. You can collapse and expand Internet addresses, domains, and file paths, and a scheduler lets you run automated reports.

For finer analysis, you can add constraints to the categories. For each data set, Web Tracker provides a list of possible constraint options, which it generates dynamically. For example, if the product



Web Tracker produces a chart showing file types accessed while filtering on Agent.

reports that ten types of browsers have accessed your site, it will display each type as a constraint option. You can combine constraints, but you can't search by Boolean OR. Finally, a significance filter drops any results that contain a negligible number of entries. There is no click-stream tracking.

Web Tracker generated reports in chart form only. When you click on a bar, however, the program displays the underlying data. You can save charts as GIFs, print them out, or export the data into a variety of delimited text formats for import into a spreadsheet or database.—RPL

Web Tracker 2.1. List price: \$495. Requires: 486-based PC or better, 16MB RAM, 10MB disk space. Cambridge Quality Management Inc., San Francisco; 415-564-4553; www.cqminc.com. Choose 541 at www.pcmag.com/infolink. PC

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Net Tools



Microsoft Windows NT Server 5.0 vs. NetWare 5.0

The beta versions of these upcoming NOSs are Enterprise-ready and thick with TCP/IP services.

By Mark Stanczak

They're coming! But should you care? PC Labs loaded and tested the latest beta versions of Microsoft Windows NT Server 5.0 and NetWare 5.0. The features and capabilities we found are hints of what lies ahead for each network operating system (NOS) and how new features can affect your organization as you consider upgrading or moving among them.

Should you switch? Which one should you choose? From our tests, we conclude that as in the past, the need for a specific line-of-business, server-based application will often drive your choice of NetWare, Unix, or Windows NT. If you have NetWare installed as your file-and-print backbone NOS, you have a bright future for growth—especially if yours is a large enterprise; Windows NT Server 5.0's new features, including hierarchical

INSIDE

NOS BETA FACE-OFF

PC Magazine Labs put recent beta versions of Windows NT Server 5.0 and NetWare 5.0 to the test. This in-depth comparative feature by contributor Mark Stanczak and project leader Robert Norton tells you how the betas stack up, and what Microsoft and Novell promise for the final shipping products.



NDS MANAGER Anyone who has managed NDS for a large enterprise knows it can be an overwhelming task. Contributing editor Padraic Boyle reviews NetPRO Computing's DS Expert 2.2, a package that can help you manage and troubleshoot your NDS tree. *Page 229.*

REMOTE CONTROL Contributor Arie Moller tests Quarterdeck's RapidRemote 1.5 to see how it stacks up against the more established competition from Stac and Symantec. *Page 229.*

SMILE FOR THE CAMERA In Multiple Access, PC Magazine Labs director Steve Buehler finds new uses for Web cameras. *Page 230.*

CABLE BASICS Internet Tools tells you all you need to know to get network cabling installed. *Page 235.*



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directory services, are impressive but will probably not convince you to switch. If your NOS options are more open, however, be aware that Windows NT is powerful enough for any job, and it can claim the widest base of industry support.

Microsoft (www.microsoft.com) has pushed back the final delivery date for Windows NT Server 5.0 until late 1998, or possibly early 1999. Another beta release this spring will provide a better measure of progress. Novell (www.novell.com) hasn't announced a specific delivery date for the next NetWare release, but its officials have promised NetWare 5.0 by the end of 1998.

In this roundup, we've taken the wraps off the beta versions of these products and met with company officials to get a glimpse of the next-generation NOS software from the labs of Microsoft and Novell.

What's new? Windows NT Server 5.0 now sports Active Directory, and as evident in the beta version, Microsoft is rapidly modifying back-end components to fit into its newly refurbished directory service. NetWare's application-servicing future lies in Java. Microsoft seems to be more interested in reducing total cost of ownership at an administrative level, whereas Novell is far more concerned with reducing it at the end-user level.

What's changed? Most of the changes Mi-

crosoft and Novell are revealing will be appreciated only if you also upgrade your client-networking software. But the latest efforts

Microsoft and Novell are putting into reducing the cost of running a network may be their saving grace. Low cost of ownership might justify the price of a software upgrade—but probably not a full-blown conversion.

Based on functionality, we've divided up our NOS-beta roundup into six key areas: file and print, directory services, Internet connectivity, application servicing, total cost of ownership, and migration. In each section, we investigate what's changing and where one solution might be better than another.

CHANGES? WHAT CHANGES?

The NetWare 5.0 beta showed us one startling change that's headed toward Novell supporters: a graphical user interface (GUI). The development team is currently converting the text-based console screens to Java-based GUI screens. Still, there's something odd about seeing a mouse connected to a NetWare server.

Microsoft's new Active Directory (AD) will have the most impact on Windows NT 4.0 shops. It is hierarchical and supports inheritance, and programmers can merge the service into applications. These are significant improvements to what was a mere flat-file system in Windows NT 4.0. With the new Dy-

namic Domain Name Service (DDNS) linked to AD, managing Internet names and addresses will be a centralized procedure in Windows NT 5.0. In a nutshell, everything in Microsoft Windows is getting tighter with Active Directory. Given time to mature, AD could well encroach on Novell Directory Services (NDS), but at this point NDS is still the more robust directory service.

In fact, we see a lot of movement by Microsoft and Novell toward each other's space. Windows NT Server 5.0 is playing a little catch-up by revamping its directory, whereas NetWare 5.0 is taking aim at serving up and developing applications. Novell went back to the development labs and completely rewrote NetWare's kernel to gain full multiprocessing capabilities. Big multiprocessing applications have traditionally run on Unix or Windows NT. Microsoft had to tack on nearly 40 percent more code, largely in the form of add-on services that enrich its file and print serving potential.

At the same time, a good portion of each product environment is familiar. Installation routines may have come nearly as far as they can, since neither the Windows NT Server 5.0 nor the NetWare 5.0 beta shows any noticeable improvement. Read on to get more details of how the two NOSs stack up in individual features and environments.

File and Print

Almost every service in the NOS relies on the internal file system for rapid data storage and retrieval. An industrial-strength file system should be fast and reliable yet secure and immensely scalable—features that in Versions 5.0 Microsoft and Novell are continuing to develop. Microsoft's new file and print capabilities cover a lot of ground by catching up to NetWare, and at the file-service level, the differences between the two are rapidly becoming moot.

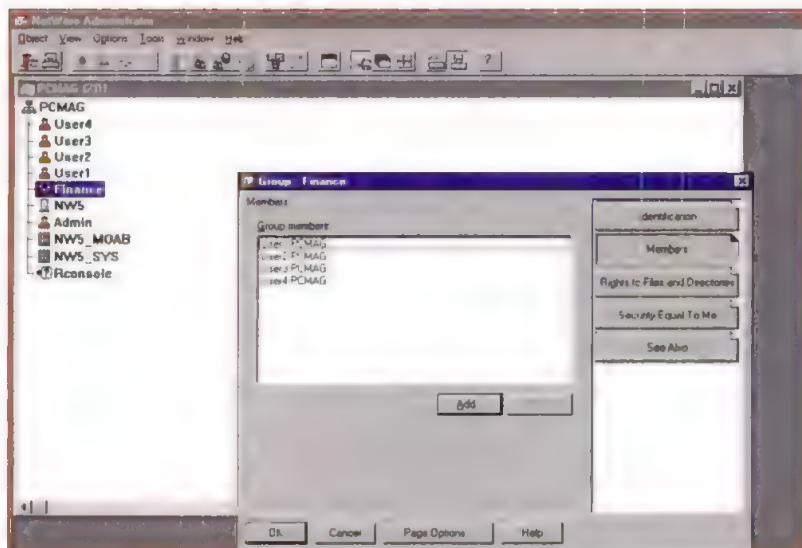
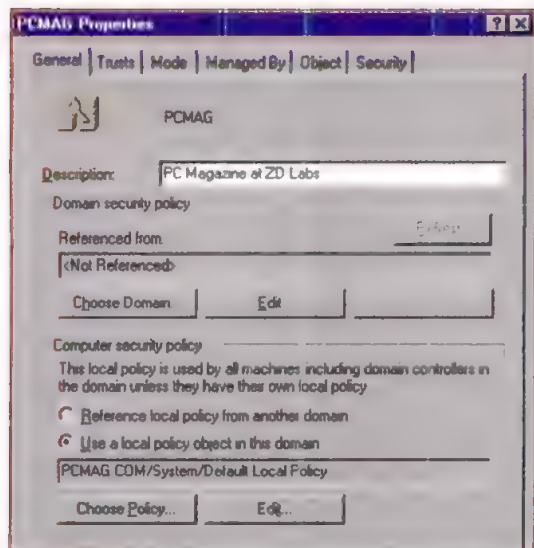
Many of the enhancements each vendor has made to its file system merely fill gaps that the other has already covered. For example, NetWare long supported per-user disk space quotas but lacked a multiprocessor-enabled file system. As found in our beta software, the new Novell Storage Services (NSS) in NetWare 5.0 can finally accommodate multiple processors as Windows NT does. And conversely, Microsoft's new NT File System (NTFS) in Windows NT Server 5.0 sports per-user disk quotas.

The Distributed File System (DFS) from Windows NT 4.0 has been updated and incorporated into Microsoft's new Active Directory. Using Windows NT Server 5.0's new console Microsoft Management Console

Microsoft Windows NT Server 5.0 vs. NetWare 5.0 at a Glance

At a glance or in depth, Microsoft Windows NT Server 5.0 and NetWare 5.0 are highly competitive. Microsoft's strong development tools and services for applications make it a popular platform for business line and Web-based programs. But Novell's early investment in directory services continues to pay benefits in other areas such as the applications environment and the cost of operations. It also has a strong partner in Netscape.

	Microsoft Windows NT Server 5.0	NetWare 5.0
File and print services	Plug and Play makes storage and printer upgrades easier. File access is fast enough for any application. Clustering for high-availability servers is ready from several hardware vendors	For certain printers NetWare offers significant new printing services. A new graphical user interface for setup and management makes NetWare less arcane. You can get proven high-availability server options now. Clustering is coming.
Directory service	When available, the new Active Directory will be powerful yet conservative.	NDS gets better and better. NDS for NT works well to integrate Windows NT servers into NDS networks.
Application services	Can handle more CPUs than the user is ever likely to have. Popular development tools; rich communications, database, and messaging services for applications.	Fortunately, NLMs are out of Ring 0. True multiprocessing runs big applications. Popular database-engine and communications services for applications.
Internet connectivity	IIS 4.0, Transaction Server, and Index Server are set up for e-commerce. Dynamic DNS makes IP addressing and domain management easier.	All the pieces are there, plus good integration with Netscape products. FastTrack Server is integrated into the NOS.
Total cost of ownership	Microsoft has initiatives to control costs throughout the network by automating software upgrades, using thin clients, and prohibiting changes by end users	Novell is focusing on the end-user side to control costs. Management and applications integrated with NDS reduce overhead
Upgrading and migrating	Microsoft is looking forward and trying to move people to new server and client software. Moving to Active Directory will take planning	Novell has introduced features for older versions of NetWare. Moving to NDS is a challenge, but the move to NetWare 5.0 should be smooth. NDS for NT is a powerful integration tool



IN THESE BETAS, Windows NT 5.0's directory services remain domain-centric, while NetWare 5.0 continues to use the well-proven NDS.

(MMC), we were able to browse through the directory and find file servers and disk volumes, as we have done with IntranetWare using the NDS browser.

One of the most glaring problems with Windows NT 4.0's file system is that it isn't replicated. By leveraging the replication capabilities in Active Directory, Windows NT Server 5.0's DFS now permits mirroring across multiple servers. NetWare 5.0 attains a similar capability using NSS.

Though the existing NetWare file system remains intact, NSS is designed specifically to support clusters. It lets data reside on several devices simultaneously. Spread across numerous servers, the addressable data must increase; in NetWare 5.0, Novell increases the amount of addressable data to 8TB. Unfortunately this capability didn't make it into our beta unit.

Microsoft has improved the security in Windows NT Server's file system by adding file-level encryption to Version 5.0—a beta feature that works. You can use this feature to prevent multiple users from accessing private files on a local-storage resource. It let us configure several levels of management at the server console. Since you still can't log on to a NetWare server, this isn't an issue for NetWare shops. Still, given Microsoft's user profiles and ability to log on to the Windows NT server console, file-level encryption will be a valuable feature where any number of administrators can directly access the server.

With a new Dynamic Volume Management capability promised for Windows NT Server 5.0, volume size should soon be extendable or changed without interruption of file services to users. According to Microsoft, other upcoming improvements to Windows NT's file sys-

tem will even prevent application shortcuts from pointing to nonexistent resources.

There's at least one area Microsoft hasn't touched: print servicing. Maybe the company is contented letting print-server manufacturers drive the business, whereas Novell appears to have decided on a leadership role. That company's agreements with Hewlett-Packard and Xerox are finally bearing fruit with the new Novell Distributed Print Services (NDPS) in NetWare 5.0. By establishing a bidirectional standard between the directory and devices external to the file server, Novell has increased tenfold the status information to be passed from network to client workstation. Imagine sending a large job to a printer and being informed there isn't enough paper or toner to complete it. Even though all these promises aren't as yet fulfilled, the basic concept is valid, and many beta components are already in place.

Much of Novell's NDPS technology may require the blessing of the device manufacturers when a vendor has the support of HP. But Novell has already gained the lion's share of the business printing market. Fortunately for this vendor, its new NDPS should be fully backward-compatible by the time NetWare 5.0 ships.—*Mark Stanczak*

Directory Services

Directory services map and control the users and resources on a network. If you have only a few servers, then simply logging on to one server and having rights assigned to you works okay. But that system falls apart when you have dozens or hundreds of servers in widely distributed locations. People want to find resources using logical names and to log on from

anywhere in the network without taking extra steps. Growing and dynamic networks need a good hierarchical directory service.

Novell assumed the industry lead with the introduction of Novell Directory Services (NDS) in NetWare 4.0. Microsoft is playing catch-up, and in this beta we don't yet see that Microsoft's Active Directory (AD) provides the administrator with enough useful tools to consider AD as an enterprise-ready directory service. In the beta, the administrative tools let you administer any one of your existing domains by choosing them from a list (in a new administrator console) one at a time. All this does is consolidate your management in one single interface. In the future, Microsoft says you will be able to maintain the directory more flexibly.

NDS lets you have multiple locations open at the same time, and the directory service considers them to be part of one large tree. This is important, because managing separate domains or sections of your directory tree is time-consuming and requires good records on where things are and who has rights to what. NDS lets you search for and administer objects in relation to other objects within the tree without having to create "aliases," or placeholders, for objects elsewhere in the tree.

We saw a true hierarchical tree structure in the new Microsoft AD. In this scheme, organizations contain Organizational Units (OUs), which in turn contain various users, file systems, and other named resources. But one difference between AD and NDS is that in AD, OUs are basically just places to hold other objects; they have no security properties of their own. In AD, the OU is just a container and not a security principle. Instead, security principles, such as users and groups, can

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appear in access control lists.

Microsoft reportedly designed AD this way to allow fine control and to limit situations in which groups inadvertently gained rights. For example, if the network manager of the engineering department granted the marketing department rights to use engineering's printer, any changes that marketing made to its access control list would be reflected in engineering's printer access control. In some situations, such changes could lead to loss of control. In NDS, every object in the directory is a security-enabled container unto itself. You can put objects in a specific OU and grant rights to that OU; then any user added to that OU would inherit those rights.

On the one hand, Microsoft's approach is conservative and avoids surprises. On the other, it limits flexibility and can in some circumstances create more work for the administrator. Which do you value more, safety or flexibility? Our PC Magazine Labs staffers favor flexibility, but their jobs aren't on the line.

In AD, you can now create groups that span across domains. This makes it easier to give specific groups rights to multiple resources with a single action. Again Microsoft takes the conservative approach; the rights in AD don't flow downstream. You must either give users specific rights to large areas of a domain tree or set up groups that have the spe-

cific rights to resources.

In NDS, you can assign administrative rights either directly to the group or somewhere above the

group. Rights flow downstream and are cut off by Inherited Rights Masks. As long as you have the right masks in place (something you design from the beginning), the rights flow smoothly. If a user is getting rights someplace where these rights shouldn't be, NDS can track them and tell you whether they were granted explicitly to the user or inherited from a group membership. You then can remedy the situation easily.

It's important to note that Microsoft does not, at the time of this writing, plan to create an updated client for Windows NT Workstation 4.0 or Windows 3.x. This means that if you want all of your clients to be authenticated and managed by AD, you have to upgrade all of your current users to Windows 95, Windows 98, or Windows NT Workstation 5.0. If you currently run a Novell shop, stick with it. Novell's NDS is strong, and NDS for Windows NT brings Windows NT clients under Novell's umbrella.—Robert Norton

Internet Connectivity

Getting a strong suite of Internet-centric services is becoming a major concern for network administrators. In their beta versions,

Windows NT Server 5.0 and NetWare 5.0 have moved from merely IP-friendly to IP-dominant. But neither has a clear edge regarding Internet features.

Each product integrates a DNS server in its directory management schemes to ease name administration and to leverage automatic name-assignment benefits. Having a DNS isn't new, but the integration of address and name services is both new and important.

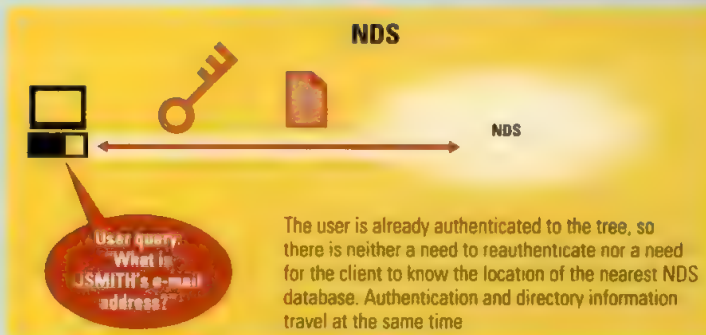
In the Microsoft networking environment, a new Dynamic DNS (DDNS) looks destined to replace the old WINS (Windows Internet Naming Service). DDNS provides name-to-address/address-to-name mapping and resolution on the fly. It's described in RFC2136, which is mirrored on many Web sites. Generally, DDNS is a great service, but adopting it could be a hassle for companies with large DNS infrastructures. In Windows NT Server 5.0, DNS names must match Windows NT Domain Names, or else the directory and DNS aren't in proper sync and administration becomes a tedious proposition.

In NetWare 5.0, Novell is continuing to hedge its name-resolution options with Dynamic Host Configuration Protocol (DHCP) and will be using NDS as the back-end database. A Java applet hooks in for management.

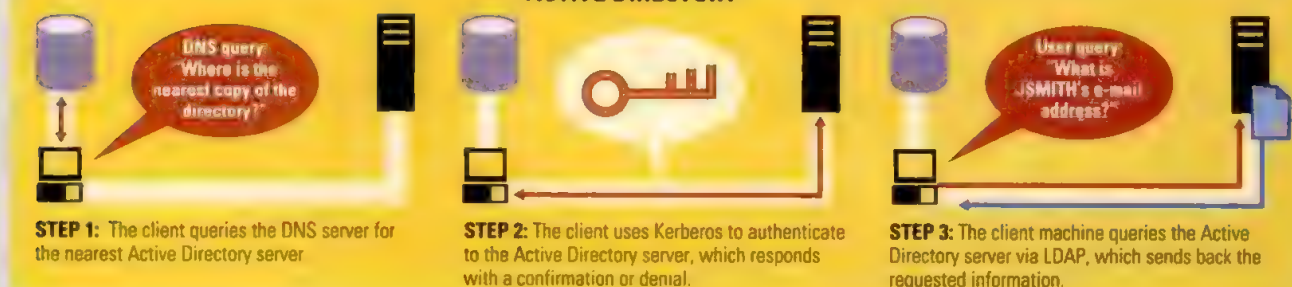
Novell spent a decade building support for its IPX network protocol. (Even Microsoft followed along in Windows 95.) In NetWare 5.0, the vendor is nearly throwing away IPX.

NDS vs. Active Directory

In both NetWare 5.0 and Windows NT Server 5.0, the directory service uses an interactive lookup process to authenticate users and their network rights. Windows NT's new Active Directory is based on existing standards such as DNS, Kerberos, and LDAP, but its lookup process requires a few more steps than that of NetWare Directory Services (NDS).



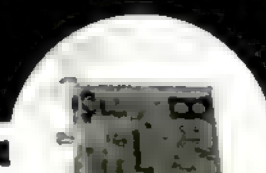
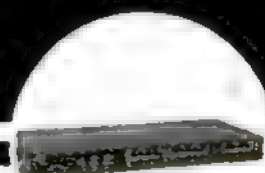
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Net Tools

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You have three options: tunneling IPX within IP, going completely with TCP/IP, or using an IPX-compatibility mode. In another move toward IP, Novell has replaced the bandwidth-consuming Service Advertising Protocol (SAP) with Service Location Protocol (SLP) RFC2165, a naming and discovery service that intelligently minimizes redundant broadcasts over IP networks. Of course, creating a

could hardly tout them. I2O offers a performance boost gained from off-loading I/O functions from the main CPU resources. (For back-

ground, see "Beating the Bottleneck," January 20, 1998.)

Server clustering is starting to make more sense, but the beta offerings from Microsoft and Novell show little progress. The Microsoft Cluster Server is limited to a two-node cluster, and Novell continues to espouse System Fault Tolerant (SFT) Level III as its two-node-cluster solution. Both vendors claim that their final products will support multinode clustering.

Microsoft vows to improve overall compliance with ATM devices and standards such as ATM LAN Emulation and TCP/IP over ATM—using either ATM Address Resolution Protocol (ARP) or

Multicast Address Resolution Service (MARS) by the time Windows NT Server 5.0 ships. This is a bet on ATM's long-term future.

One final notable technology that both Microsoft and Novell are promising in their next releases is administrative-level control over CPU and memory utilization by application. This means limits can be put on various services to prevent them from taking over the majority of computer resources. For example, to avoid a huge jump in Web activity affecting normal operations, you could limit the Web-serving service to 20 percent of CPU time.

—Mark Stanczak

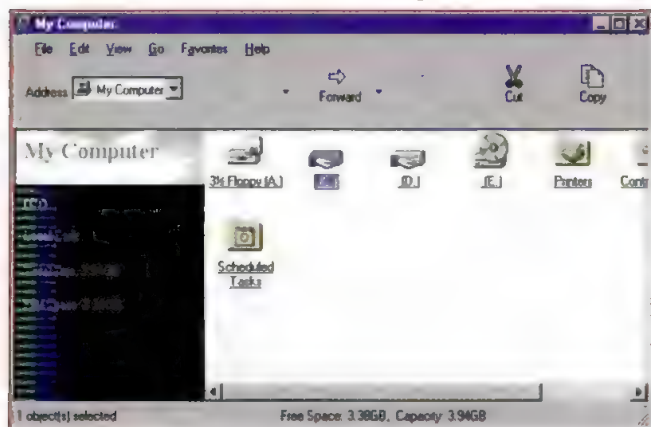
oriented development environment is far more effective than Novell's programming tool set.

But Novell is still up to challenging Microsoft. Most important, NetWare 5.0 takes applications out of Ring 0 of the processor, which was a notoriously unstable situation. NetWare 5.0 NLMs can now run at Ring 2, a much safer although more performance-consuming alternative.

Novell Directory Services has the power and flexibility to manage application access. The Novell Application Launcher (NAL) ties applications in with NDS. This tie provides central management with privileges and application parameters. In NetWare 5.0, Version 2.1 of NAL gains the ability to grant file-access rights to users when applications are launched, replacing the need to assign them in a separate administrative process. NAL and NDS menus flow together smoothly. Unfortunately, Novell has hinted that NAL might not be free by the time NetWare 5.0 ships; the company may opt to make it a component of a new TCO feature add-on package called Z.E.N.Works.

Not to be outdone in the software distribution space, Windows NT Server 5.0 features a new Application Installation Service, a tangible piece of Microsoft's ZAW (Zero Administration for Windows) initiative. Using the Group Policy Editor—a snap-in to the Microsoft Management Console—we were able to modify user profiles and computer settings, then either publish or assign applications to our client workstations. This capability makes managing client access to server-based applications less repetitive.

The environment for developing applications is probably one of the most important differentiating factors between Windows NT Server 5.0 and NetWare 5.0. The development tools for Windows NT clearly have the



JUST BROWSING: The much-argued Internet Explorer pieces of Windows NT turn your desktop into a browser.

full IP LAN brings with it all the addressing hassles of IP, but DNS is a help.

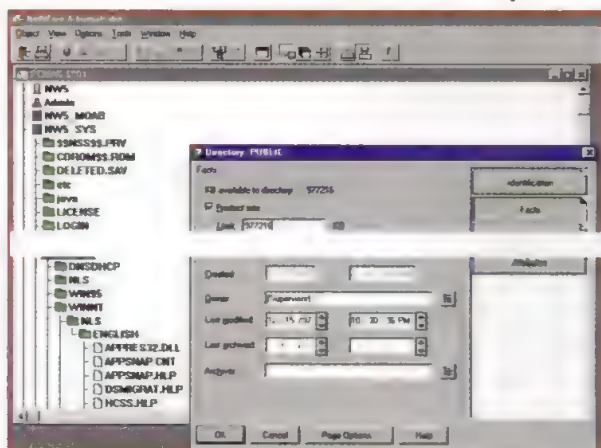
The Web server battle heats up again: Microsoft's strong Internet Information Server (IIS) 4.0 will be rolled into Windows NT Server 5.0 to face off against a version of Netscape's FastTrack server. But if Microsoft includes its Index Server, Message Queue Server, and Transaction Server with Version 5.0 as planned, Novell will be forced to play catch-up. At this time, the linkage between IIS 4.0 and Transaction Server gives Windows NT Server 5.0 the edge over NetWare 5.0 in handling e-commerce functions. Based on the excellent job Microsoft has done with wizards in its BackOffice Small Business Server, the ease of creating and managing an industrial-strength Web server based on Windows NT will be hard to match.

Getting into the network from the outside is another bag of tricks. This time around, Novell has decided to include NetWare Connect in its package. Tightly integrated with Novell's proven Multi-Protocol Router, the combination should run neck and neck with Windows NT 5 (Remote Access Service). Apple lovers will applaud the new Macintosh remote-access features in Windows NT 5 RAS.

On the plumbing side, both Windows NT Server 5.0 and NetWare 5.0 give life to the I2O hardware already in some servers. Vendors have been shipping I2O features but

Application Services

Specially written applications often take advantage of an operating system's programming environment, database engine, naming service, and other features to boost performance or to simplify operation. In the application server space, Microsoft Windows NT 5.0 inherits the strengths of its predecessor, Windows NT 4.0, and looks as if it will be hard for NetWare to beat. Windows NT is immensely scalable, and the graphically



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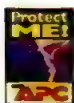
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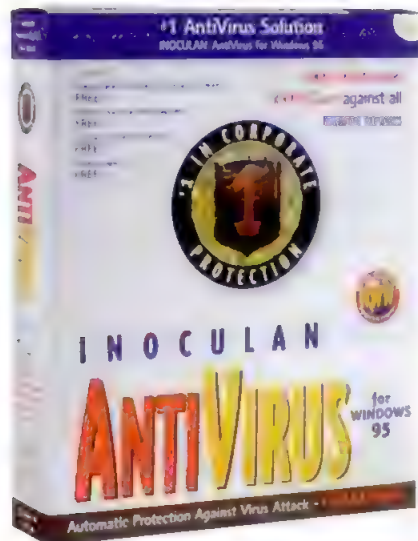
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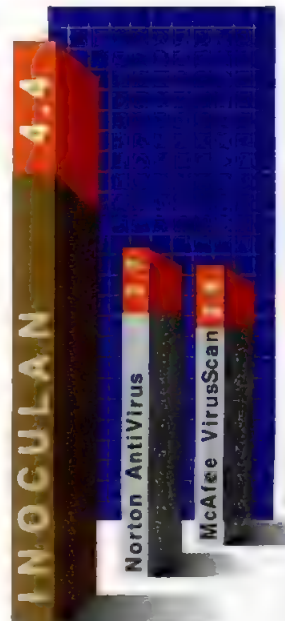
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July 1997 scores from LANtimes Virus Protection Shootout.

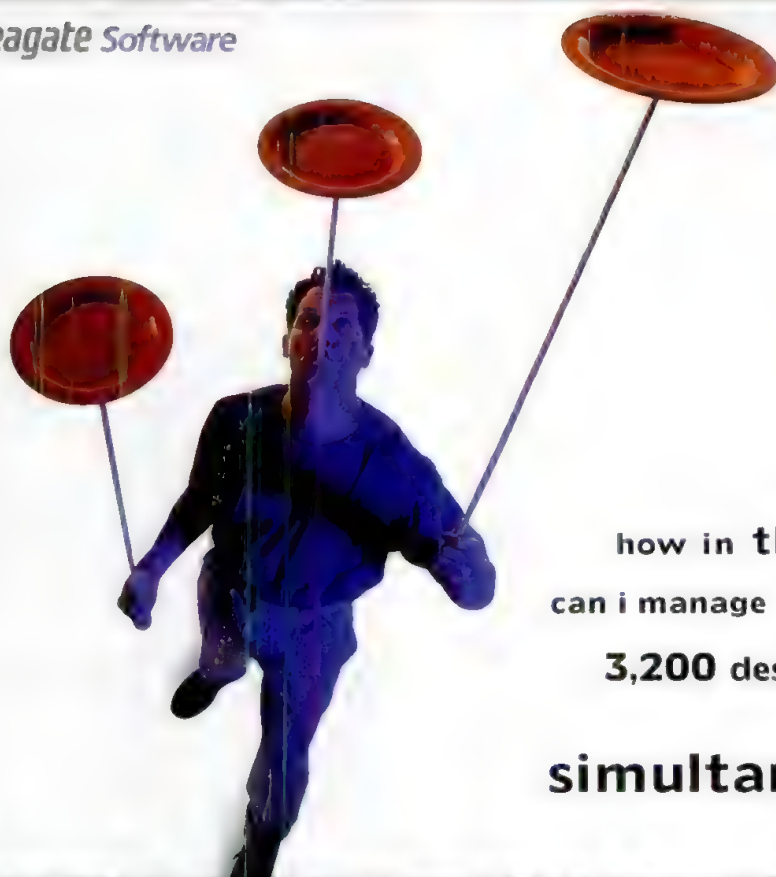
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mind share of the C++ and, to a remarkable extent, the Visual Basic programmers. The Active Directory Services Interface APIs, the necessary elements for building directory-enabled applications, will be in place when Windows NT 5.0 ships.

The NetWare 5.0 beta demonstrates that Novell is well on the road to Java—although the road is not yet fully paved. In NetWare 5.0, an MPK-aware Java Virtual Machine (JVM) has been incorporated into the operating system. The Java Development Kit from Sun Microsystems is used to code applications for the JVM. At the server console, we could toggle to the JVM screen and load several sample applications in the form of HTML files that demonstrated the look and feel of the Java engine.

As network administrative tools, the Java applets are effective but ugly. They cannot compare with the refined nature of Windows NT's new Explorer-styled GUI.

In a similar fashion, Microsoft is planning to include the Windows Scripting Host (WSH), which ties in other languages such as Java, Perl, or REXX as scripting engines. Scripts can be run from either a Windows client or the console.

A more significant improvement for platform application development in Windows NT Server 5.0 is the Win32 Driver Model (WDM). Following this new model, programmers can code a single device driver for both Windows 98 and Windows NT Server 5.0. With the addition, finally, of Plug and Play into Windows NT Server 5.0, hot-swappable components such as RAID storage or PCI cards will now be supported at the operating-system level rather than by shims that use questionable techniques to deal with components coming online and off-line.—MS

TCO Control

Neither Windows NT Server 5.0 or NetWare 5.0 will help you find better deals on purchasing new PCs, but each will help in reducing the time spent administering the network and clients. Although we weren't able to see anything of Novell's new Zero Effort Networking (Z.E.N.) product, slated for release by June 1998, many of the Z.E.N.Works features Novell describes probably could make it easier to perform the daily tasks that consume an administrator's time.

Microsoft has come up with some great solutions to some common problems, but we don't think the problems they solve (mostly application installation and policy implemen-

tation) make up the greatest part of an administrator's nightmares.

The beta version of Windows NT Server 5.0 includes many features we discussed in a recent story ("TKO Your TCO Today," *PC Magazine*, October 21, 1997). Features in the new MMC provide system administrators with a single interface for administrative tools and for viewing network functions. The Group Policy Editor and the Application Installation Service, both part of Microsoft's Zero Administration Windows initiative (ZAW), let administrators set policies on how each user interacts with the OS and applications. It appears that ZAW's goal is reducing the time administrators spend walking to users' desks.

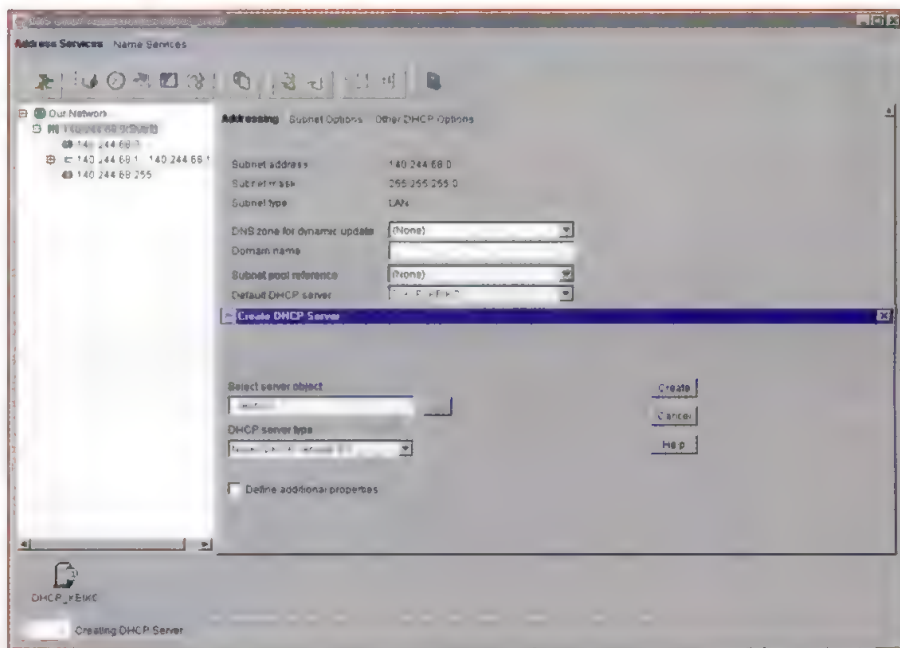
According to our briefings, the Application Installation function of Windows NT Server 5.0 will install, repair, remove, and track the

4.0 will work with Z.E.N.Works.

Z.E.N. Desktop Managementworks will make the client PC itself an object in the directory, and all the hardware-inventory information for each client will be stored there. Z.E.N. will also prompt client PCs to log on without user intervention, lock the console, and distribute and run applications.

NetWare's Dynamic Policies seem a little more flexible than the similar Group Policy Editor in Windows NT. Under NetWare 5.0, you can go into any workgroup's NET.CFG file and change the Packet Receive buffers or other parameters that affect how the workstation uses the network. The Group Policy Editor in Windows NT can change networking parameters for your clients, but it cannot interfere with the boot process.

At boot time, Novell's Z.E.N.Works compares what is on your user's hard disk with the workstation object in the directory ser-



ONE AND ONLY: Novell's new Java-based DHCP administration console provides a single basic interface for setting up DHCP options.

dependencies of applications. Since it is transaction-based, your installation can be rolled back if things don't go as planned. Applications can also be designed to install their components on an as-needed basis with the new Just In Time (JIT) installation feature. JIT loading would particularly benefit line-of-business applications designed with many modules for different functions.

Novell has jumped on the "Z is for Zero" bandwagon with Z.E.N.Works. It will provide Application Management, Desktop Maintenance, and Desktop Management. Any current Novell client that works with NetWare

vice. If the Directory Service (DS) workstation object has been updated with a new NET.CFG file or any other new parameters, the workstation will update itself, then continue booting.

Novell has tied remote-control information to the directory. When a help-desk employee wants to control a user remotely, it's easy to right-click on that user in the directory and pick Remote Control. The help desk application will forward the correct information when a trouble ticket is created. All the information about the user's environment (including user name, context, hardware in-



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ventory, and in the future, all software contained on the user's hard disk) is contained in the available directory.

Judging from what we saw in Windows NT Server 5.0 and what we heard about ZEN, we expect that both of these initiatives will provide the administrator with tools that significantly reduce the time-consuming chores of network administration. Setting up policies and configuring clients is a big up-front job, but over time it should have a substantial payback.—RN

Upgrading, Migrating, Cohabiting

When you start moving users and printer queues between servers that are running different NOS versions, anything can happen. And since this is only round one of beta, neither Windows NT Server 5.0 or NetWare 5.0 was equipped with functional migration utilities. But we're happy to see that both Microsoft and Novell are well aware of the need for powerful methods of moving users and applications between operating systems.

If both vendors follow their current upgrade paths, each will include migration tools that move nearly all of the resource data from Windows NT domain-based systems and from the NetWare Bindery to the latest iterations of their respective directories. But modeling the migration before you actually do it is a real plus when switching from Windows NT to NetWare or vice versa, and both Microsoft and Novell promise to include that capability by ship time.

Network administrators will find Windows NT's migration utilities stronger because they can process both Windows NT and NetWare user privileges, whereas Novell's utilities work only in NetWare environments.

For its new Active Directory, Microsoft promises a Directory Service Migration (DSM) tool that basically looks out on the network and discovers NetWare resources. You then can toy with the conversion parameters before actual implementation until you reach migration managers' nirvana. The whole goal is to



minimize post-upgrade administration at the user level. For upgrades from Windows NT 3.51 to Windows NT 5.0 using the same hardware,

DSM will convert the SAM database to Active Directory. Of course, until we see it, this remains just another promise.

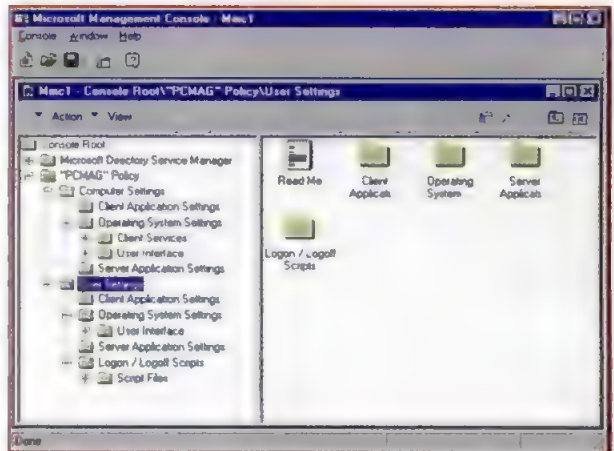
NetWare 5.0's migration utilities, like the utilities in previous versions of NetWare, are designed to bring networks up to 5.0 status from earlier versions of Bindery and NDS-based NetWare (3.x and 4.x) systems. Novell doesn't seem interested in making its secret Windows NT-to-NetWare migration tool available in the NetWare 5.0 package. Novell's latest add-on utility, NDS for NT, isn't really designed to replace Windows NT services with NetWare services but instead is designed to let them peacefully coexist while NDS operates as the single point of administration. This technology can be found today using InternetWare 4.11.

Both approaches, though, generate the same concern: how to handle user passwords, since they don't get transferred during most migration procedures. Both Microsoft and Novell offer several optional methods of resetting user passwords, but some of them have the potential of leaving the network almost entirely exposed—a real no-no.

Client updates will accompany upgrades to the NOS. In testing both Windows NT Serv-

er 5.0 and NetWare 5.0 betas, we had to use specific client operating systems to access all the new capabilities each NOS was proclaiming. We used Windows NT 5.0 Workstation (beta 1) to communicate with our Active Directory and a later version of Novell's IntranetWare Client for Windows 95 to get in touch with NDS. In its beta state, NetWare 5.0 required the use of Novell's latest 32-bit client.

Although both products had some level of backward compatibility at the client level,

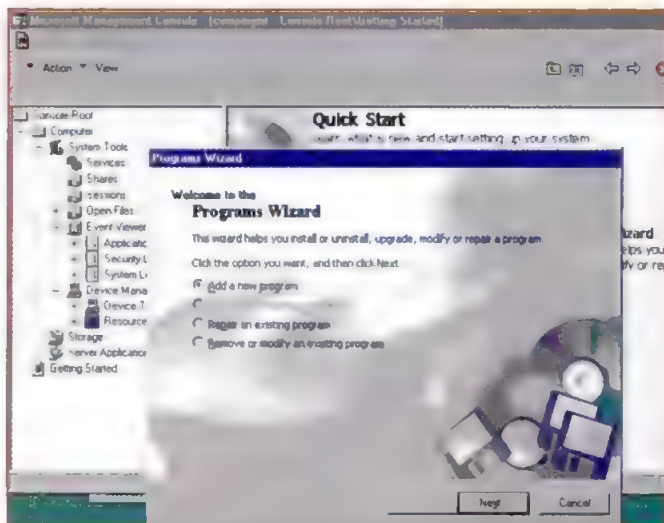


MANAGEMENT CENTRAL: Microsoft Management Console's policy editor lets you set parameters for each user's desktop functions.

Novell appears willing to extend as far back as Windows 3.x, while Microsoft, it seems, is betting that everyone at the client level is willing to upgrade to Windows 98 or Windows NT 5.0 Workstation anyway. In the enterprise, until all Windows NT 4.0 servers have been converted to Windows NT 5.0 with Active Directory, you'll get only Windows NT 4.0-level features provided through a Windows NT 4.0 emulation mode where the name space is a flat file.

As incredible as it may seem, neither new network operating system will require more hardware resources. That doesn't mean consumption won't go up. Plop in more memory (up to 4GB now) and more CPUs and you'll get a more adept server. Since NetWare 5.0 sports a new multiprocessing kernel (MPK), as evident in the beta, its appetite for processing resources should keep up with Windows NT's, which has now been increased to 32 CPUs!

The backup landscape has also changed significantly, and devices such as recordable CD-ROMs and Iomega Zip Drives are becoming acceptable means. In Windows NT Server 5.0, Microsoft will release a new backup utility that conforms to its NT Media Services abstraction layer to provide support for a far greater range of backup devices. Novell appears content to let its backup options remain basically the same.—MS PC



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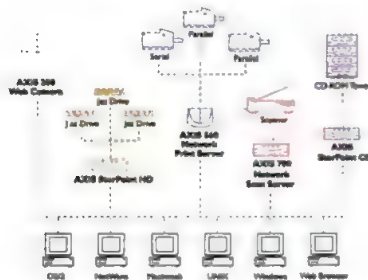
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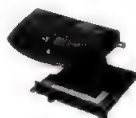
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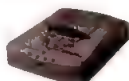
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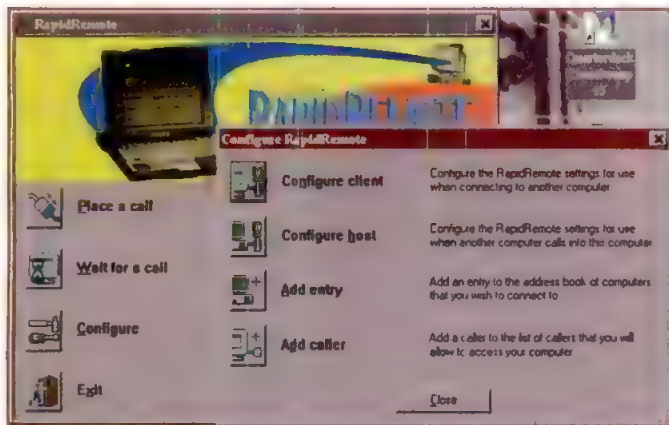
Next Best Thing to Being There

By Arie Moller

If you are on the road and need to access your office desktop, Quarterdeck's RapidRemote 1.5 (\$70 street) is an easy and inexpensive solution. Unlike Windows 95 and Windows NT, which limit built-in dial-up networking to file transfers, this latest version of RapidRemote runs all applica-

form help functions.

During installation, RapidRemote gave us the choice of installing a host, client, or host-and-client setup. We also had the option of connecting our remote system to our host via direct serial cable, direct dial-up, the Internet, or a LAN-based SPX or TCP/IP connection.



RAPIDREMOTE'S configuration wizards make setup a snap.

tions locally on the host system while sending the graphical user interface to the remote system. RapidRemote supports a mix of Windows 3.x, Windows 95, and Windows NT hosts and clients. We liked RapidRemote's overall stability, not to mention its security features: Quarterdeck has included data encryption and host-machine screen blanking, as well as keyboard and mouse locking. Unfortunately, we could not get the screen-blanking feature to work with the STB Velocity 128 graphic cards in our test systems. We also noticed that RapidRemote had problems recovering LAN-based connections, making it difficult for the software to per-

When we launched the program, a simple four-icon main-menu screen gave us the choice of placing or answering a call, configuring the host and client, or exiting from the application. We like the fact that RapidRemote's wizard-based configuration utility, which resembles Windows Explorer, made it so easy to configure the host and client. Each step is explained in detail via a pop-up text box at the top of the screen. Once we finished configuring, we were able to transfer files, surf the Web, check e-mail, and reboot the system without any difficulties.

We tested RapidRemote using two 266-MHz Pentium II Gateway 2000 machines, each with

32MB of RAM and Windows 95 OEM Service Release 2.0. Each system was also equipped with a Gateway Telepath 56-Kbps modem and an Adaptec Cogent 10/100 Ethernet adapter.

Both machines were set to 800-by-600 resolution and 16-bit color and, for all timed tests, had encryption disabled. During the first test, we hooked the two PCs up to a Bay Networks BayStack 100-Mbps hub and timed the transfer of a 4MB file from the host to the client. RapidRemote poked along at a slow 0.4 Mbps but fared much better during our dial-up test, in which we transferred a 469K file from the host to our client over a 33.6-Kbps connection at a rate of 52 Kbps using data compression.

Knowing that breaks in transmission occur too frequently for most remote users, we also wanted to see how well RapidRemote would recover from unexpected

breaks. We set the host computer to reboot and launch RapidRemote automatically. Theoretically, this setup should allow the user to reestablish a session. But in reality, this wasn't the case. During the first test, we physically disconnected the PCs in the middle of a file transfer. For the second test, we shut down the client machine in the middle of a transfer. RapidRemote didn't recover in either scenario using the LAN-based connection, but it was able to reestablish both dial-up connections.

RapidRemote 1.5 has proved to be a quick, reliable, easy, and cheap solution for dial-up remote control. But it is ill suited for a LAN-based remote-control environment, such as a help desk.

RapidRemote 1.5. Street price: \$70. Quarterdeck Corp., Marina del Rey, CA; 800-371-4566; www.qdeck.com. Choose 901 at www.pcmag.com/infolink.

MANAGEMENT TOOLS

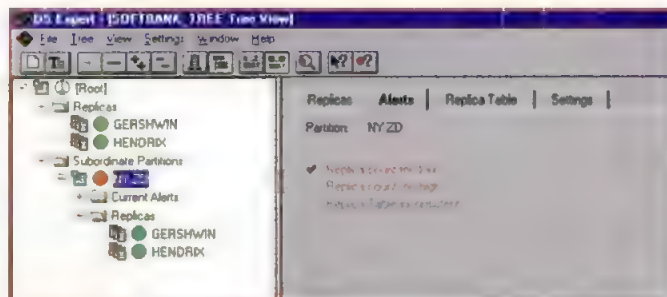
The Tree Experts

By Padraic Boyle

Keeping your NDS database completely updated and synchronized with several local and remote servers can sometimes prove harrowing, but NetPRO Computing's DS Expert 2.2 takes the guesswork out of managing and maintaining a coherent NDS tree. Moderately priced (starting at \$12 per user object), DS Expert provides a centrally managed, graphical view of your NDS tree and helps you troubleshoot directory problems. We like its easy-to-use interface and ample supply of reported sta-

tistics as well as its ability to plug in to Novell's ManageWise and other SNMP-based management applications. But DS Expert would be more to our liking if it included an error-logging feature and some artificial intelligence to automate common tasks.

Built around three main components—DS Expert Agent, Tree Monitor, and Windows Client—DS Expert's agent/monitor architecture collects important data about an NDS tree's health while generating only minimal additional network traffic. DS Expert Agent, an NLM that runs on each



DS EXPERT'S Windows Client provides a graphical display of your NDS tree's health while letting you configure alerts, statistics, and thresholds.

CROSS TALK



Leon Erlanger

As our review of the beta versions of NetWare 5.0 and Windows NT 5.0 show, Frank, the two real areas of battle between the NOSs are in the naming services and in the application environment. Making network resources available and controlling access are important tasks. A tool like DS Expert fills some of the holes and makes it all roll more smoothly.

Leon, the review of DS Expert really shows how much the topic of naming services has grown. You'd think this is a pretty arcane tool, but interest in this product is high. A naming service linked to specialized business applications makes it easier for everyone to use the applications, and it really reduces the network administrator's workload.



Frank Derfler

server with an NDS partition, tracks NDS occurrences and alerts Windows Client to the operational status of IntranetWare servers.

The Tree Monitor NLM, which runs on a single network server, collects information such as partition synchronization from all DS Expert Agents on the network

and monitors the NDS tree.

Windows Client, available for Windows 3.x and Windows 95, provides a centralized and graphical real-time representation of the NDS tree's overall status. Using the client, we had a comprehensive view of the servers, partitions, and replications included in the NDS structure. We were also able

Net Tools

FROM THE BENCH

to configure alerts, statistics, and thresholds, then purge expired items and synchronize the DS schema from a single location.

DS Expert provides additional information that lets you narrow down or in some cases even pinpoint the sources of NDS errors. For example, a multitrace feature executes Novell's debugging utility DSTrace on multiple IntranetWare servers so you can view all the messages simultaneously from the management client. Remember, though, that DS Expert does not provide you with any automatic fixes; it gives you just the information necessary to locate your problem.

DS Expert's statistics page offers a useful historical view of the latest 15-minute, 1-hour, or 24-hour average of NDS transactions on a server. This data is handy for trend analysis and fine-

tuning NDS performance.

Besides using Windows Client, DS Expert can plug into Novell's management software ManageWise. DS Expert also has MIB support for other SNMP-based products such as HP OpenView and IBM's NetView.

In addition, DS Expert is easy to install. We completed our installation in less than 15 minutes. Windows Client has only one requirement: You must load it on an IntranetWare client with a minimum of 16MB of RAM and 20MB of disk space.

We liked DS Expert's documentation, which comes with a useful listing of NDS error codes in the appendix. It also provides error descriptions, explains what causes the errors, and recommends actions you can take to rectify the situations.

DS Expert 2.2. List price: \$12 per user object (1,000 users, \$12,000). NetPRO Computing, Scottsdale, AZ; 800-998-5090, 602-941-3600; www.netpro.com. Choose 900 at www.pcmag.com/infolink.

MULTIPLE ACCESS

Smile, You're on the Web

Creativity is all around us at PC Magazine Labs. Although thousands of innovative products come our way each year, *real* creativity is often most evident in how developers move their products to the next step and how vendors put the products to use on the market.

Recently I came across two inventive uses for network cameras such as the AITech AIGotcha (www.aitech.com) and the Connectix QuickCam (www.connectix.com). Users have started plugging the cameras into PCs hooked up to the Web so that anyone with a browser can check out the parking lot at the mall, look at snow conditions at a ski resort, or even see live traffic images along the proposed route before hitting the road. Many Web sites using these cameras are geared toward live adult chats, but more ingenious uses for these products have also emerged.

Take, for instance, the use of these cam-



Steve Buehler

eras as a supplement to child care. Axis Communications is installing its Web-enabled KinderCam system (www.kindercam.com) in day-care centers so parents can (virtually) drop in on their little darlings while surfing the Web at work. Though the concept offers a link from the office to the day-care center—and may provide much-needed peace of mind to working parents—it does have overtones of Big Brother. But in an age of justifiable concern over nannies and child care, this is a clever use of relatively inexpensive technology.

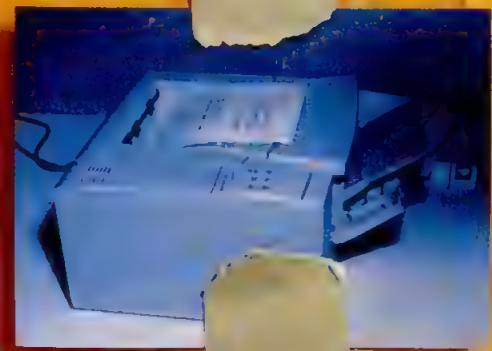
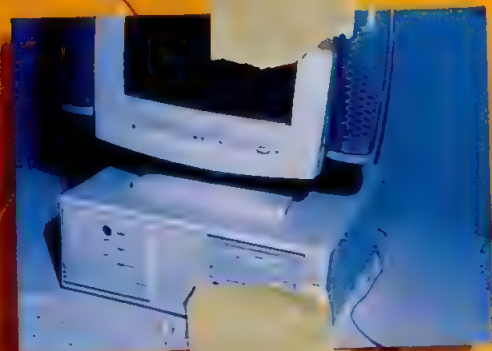
Another interesting twist comes from Darim Vision (www.darimvision.kaist.ac.kr). I got a beta version of the company's PC Snoop, which is similar to other Web cameras. This one, however, comes with novel software that lets you set up the camera as an intelligent screen saver/security device. When you're away from your PC, the

screen saver kicks in and the camera starts monitoring its frame buffer. As soon as it detects a change—someone or something moving within the field of view—the software begins to log that activity. Since it doesn't log anything when there's no activity, PC Snoop is a smart security system that operates only when needed.

The software can also function in a "greeter" mode. When the camera senses someone within range, it can play a pre-recorded presentation, which can consist of making a sales pitch, showing a product demo, or even giving directions. At a planned price of \$129 (list), PC Snoop not only demonstrates a creative streak but is also a low-cost way to establish a presence where it's just not feasible to have a person—in each corner of your trade show booth, for instance.

Web-enabled cameras have certainly taken an innovative turn from their straightforward beginnings. They're now affordable, and companies such as Darim are providing solutions that put simple security systems—even nanny watching at home—within the reach of almost everyone who has a Web connection.

How easy is it for a design firm to create a small business network?



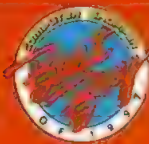
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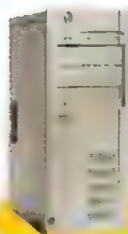
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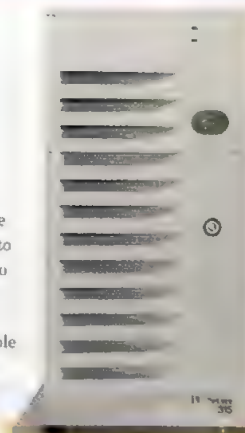
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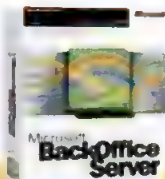


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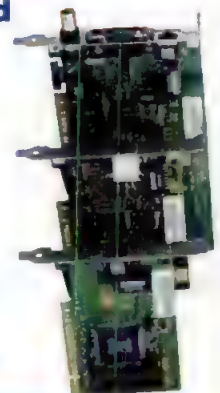
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DEP1442 HP JetDirect 10BT	\$309.99
DEP1152 HP JetDirect 10/100 Plus 1	\$199.95
DEP1490 HP JetDirect 10/100 LT	\$349.95
DEP1584 AXIS150 Print Server Dual Port Multiprotocol	\$159.00
DEP1451 AXIS 540 Print Server Multiprotocol	\$149.99
DEP1444 Net print 500E-N	\$199.99
DEP1493 Intel NetPortExpress Pro 10/100 3 Port	\$369.95
DEP1531 Intel NetPortExpress Pro 10/100 1 Port	\$259.95

POWER PROTECTION	
DEP1514 SmartUPS 300	\$79.99*
DEP1514 SmartUPS 350	\$95.99
DEP1514 SmartUPS 400	\$129.99
DEP1514 SmartUPS 450	\$165.99
DEP1514 SmartUPS 500	\$209.99
DEP1514 SmartUPS 600	\$299.99
DUP1234 BackUPS Pro 1400	\$479.99
DUP1647 BackUPS Pro PnP 280	\$139.95
DUP1252 BackUPS Pro PnP 420	\$225.99
DUP1253 BackUPS Pro PnP 650	\$269.99
DSP1489 Surge Station NETBN	\$37.99
DSP1491 Surge Station NETB	\$52.99
DSP1490 Surge Station NETBM	\$49.99
DSP1091 Network Surge Arrest NET71	\$43.99
DSP1487 Protect Net 10 100BT	\$26.99
DSP1127 Protect Net Telephone	\$20.99
DUP1214 SmartUPS 700 w/ Power Chute	\$389.99
DUP1215 SmartUPS 1000 w/ Power Chute	\$499.99
DUP1217 SmartUPS 1400 w/ Power Chute	\$629.95

*While promotional supplies last.

CABLES	
DEB1448 Cat 5 Patch Cables Maximum 10' 5' Cables and 11 Lengths	from \$4.99
DBC1730 Cat 5 Bulk - 4 pr PVC 1000 ft	\$119.99
DBC1065 Cat 1 Bulk - 4 pr Plenum 1000 ft	\$249.99
DCD1448 Cat 5 RJ45 Pairs 500 ft	\$49.99
DA1515 Cat 5 Patch Panel 24x16 24 port	\$115.99
DTO1089 PunchDown Tool 110 Style	\$49.99
DTO1030 Modular Crimp-Tool	\$49.99
DTK1040 Category 5 Termination Kit	\$179.99
DCC1916WT Cat 5 Keystone Jack TS68B	\$4.69
WDPI367 Wall Plate single port	\$2.29
TS1788 RJ45 Terminator	\$359.99
2SC1282 FiberPatch ST-ST Duplex 1 m	\$319.00
UTS1345 Pluka 350 w. 2 Way Injector	\$3995.00
TS1439 Pluka 320 Cable/Meter	\$699.00
TS1487 Progressive Tone & Probe Kit	\$99.99
TS1788 RJ45 Terminator Cable Termpor	\$79.99
DBW0331 Category 5 Install Kit	\$279.99

Net Tools

INTERNET TOOLS

CABLE INSTALLATION

Hey, Cable Man!



By John Lewis

Regardless of how much you know about PCs or about programming, network cabling is one area where—unless you're installing in a small office of less than a dozen nodes—you probably can't do the job yourself. Most companies installing a cable infrastructure contract with specialists.

FINDING A CONTRACTOR

Finding a good contractor is not as easy as flipping through the Yellow Pages, although many professionals are listed under the Computer Networking and Installation sections. The best references are word of mouth from people you know. Also, the Association of Cabling Professionals (904-645-6018, www.wireville.com) maintains a listing of contractors, and Building Industry Consulting Services International (800-242-7405, www.bicsi.org) lists design and installation professionals.

Once you've come up with a set

of potential contractors, do your homework. Compare hardware and service warranties. Some contractors guarantee their work for 1 or 2 years, but other certification programs offer protection for 15 years or more.

Also evaluate a company's experience factor by asking a bevy of questions. How many designers, project managers, installers, and support personnel are employed? Ask for résumés of people who might be involved in your installation. Is the company bonded for insurance, and to what limit is it covered? Are employees union or nonunion? How many other projects is the company currently working on, and how many people will it assign to your project?

THE BEST BID

Knowing what to ask for is as important as knowing whom to ask. The original statement of work that forms your initial bid won't be the final one. Unless you have

a lot of experience, determining the scope of the work is, unfortunately, an interactive process. But relying on contractors' input doesn't leave you at their mercy, as long as you take steps to protect your company.

Each contractor's bid should indicate cost, guarantee conformance to codes and standards, and provide a list of previously installed projects. You should use the contact names and phone numbers of previous customers to inquire about their experiences. Take the time to visit some of the installations and view the work, confirming that it is in compliance with standards and assuring that it meets flexible criteria for future growth.

Remember not to overemphasize price—to the detriment of other aspects of the project. Include factors such as performance and experience in your decision process.

CABLE MEDIA CHOICES

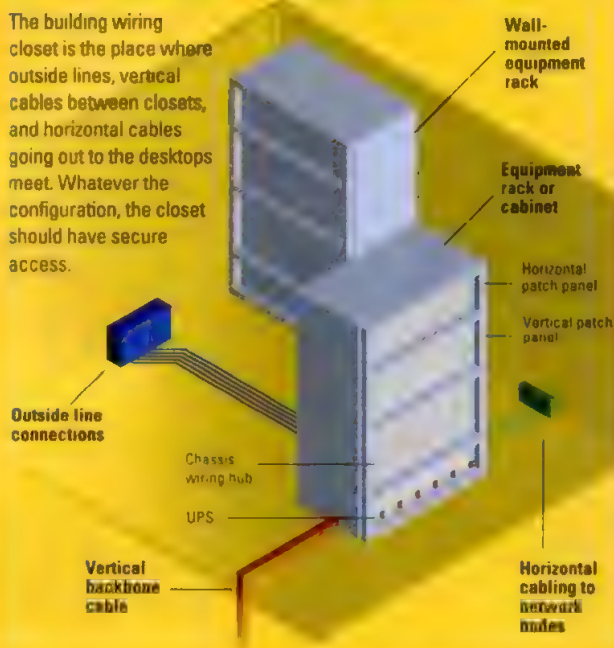
The cost of a cabling infrastructure can be formidable and is related to project size in the number of drops and the complexity of the job. Some contractors

might propose to perform the job for a set cost per drop. Be careful of these firms: Frequently, they are just trying to get a foot in the door, to be there for the change orders sure to come. You might be able to estimate installer-task costs using rule-of-thumb estimates of \$100 to \$150 per drop, but you must assume that 150 feet is typical for a Category 5 drop length. How typical is your project?

Applications requiring fiber to the desktop are becoming more commonplace, especially for high-bandwidth users and those requiring high-level security (you cannot tap fiber without breaking it or changing its signal strength). The most typical fiber circuit for LANs uses multimode, 62.5/125-micron (core/cladding) specs. Each circuit requires a duplex (transmit and receive) connection, and the fiber connector recommended by the EIA/TIA is designated as an SC; but the popular ST connector has been grandfathered. A 150-foot fiber drop costs from \$175 to \$260 per link (depending on labor rates and installation complexity), making it better suited for back-

Inside the Wiring Closet

The building wiring closet is the place where outside lines, vertical cables between closets, and horizontal cables going out to the desktops meet. Whatever the configuration, the closet should have secure access.



Net Tools

INTERNET TOOLS

bone connections and building-to-building links. The price includes hardware, labor, and testing but not the additional cost for fiber-optic connectivity at the network hub and network interface card.

ATM fiber backbones are also common, and current design allows transmission speeds of up to 622 Mbps. FDDI (Fiber Distributed Data Interface) offers excellent redundancy, with its counter-rotating ring configuration and 100-Mbps speed. ATM and FDDI can use a maximum transmission distance of roughly 2 kilometers, and Gigabit Ethernet is projected to transmit 1,000 Mbps using multimode fiber at distances ranging from 260 to 440 meters. The numbers are impressive for single-mode fiber, with 3 km promised for Gigabit Ethernet. But be aware that Gigabit Ethernet is an evolving technology, and the IEEE standards are expected to be released during the first quarter of 1998 for the fiber version. If you have Gigabit dreams, make sure your contractor is current with the technology and standards.

AN ACCURATE ASSESSMENT

If you lack in-house expertise to determine infrastructure and hardware solutions, consider bringing in an outside consultant to interpret your needs, write specifications, and possibly manage the project. At the very least, you must produce accurate drawings that reflect building space. Generate a chart that

identifies the quantities of drop types (for example, data, voice, and video) as well as those within the computer room and telecommunications closets.

Cable-drop distances will be calculated from the documents. All contractors should be responsible for verifying accuracy during their own walk-throughs. If you ask for feedback and recommendations from contractors, it puts the onus on them to come up with plans. The most successful contractors reach that status because they are good at meeting the needs of their customers and thrive on the creativity that flows in the bid situation.

Remember not to overemphasize the project's price—to the detriment of other aspects of the project.

CODE COMPLIANCE

Since you are ultimately responsible for complying with code restrictions, make sure contractor bids meet the following standards:

- EIA/TIA 568A—Commercial Building Telecommunications,
- EIA/TIA 569—Pathways & Spaces,
- EIA/TIA 606—Administration,
- EIA/TIA 607—Grounding & Bonding,
- NEC Handbook—National Electrical Code (www.nfpa.org), and
- local codes—local city and county regulations. (Some communities require cabling to be installed in a conduit, which could cost more to install than the cabling.)

The EIA/TIA standards are copyright-protected by the EIA/TIA organizations, and you can get copies to verify bidder responses via the Global Engineering Documents (800-854-7179, global.ihs.com). The National Electrical Code Handbook is provided by the National Fire Protection Association and can be purchased by calling 800-344-3555. Local codes can be obtained from each city and often

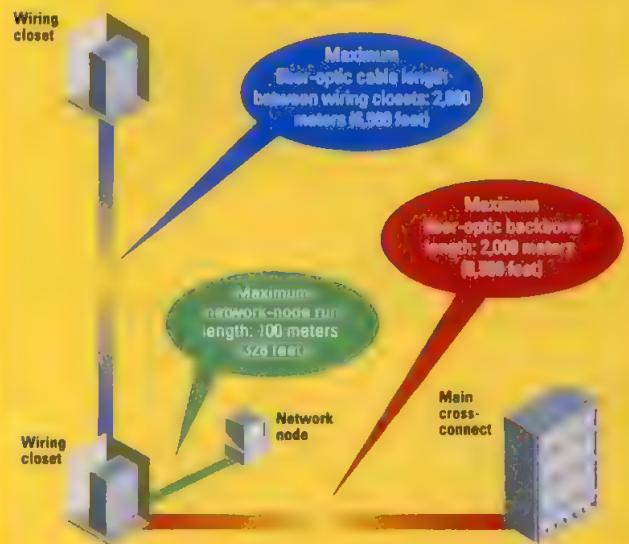
tance) or fiber-optic cable (which increases bandwidth capacity and distance parameters).

• Category 5 cable should be tested with a Level II Category 5 tester, per the TSB-67 Transmission Performance Specifications for Field Testing of UTP Cabling Systems.

The system must be grounded in accordance with the Article 250 (Grounding) section of the NEC and EIA/TIA 607. The system

Cabling Run Limits

There are specific limitations on the amount of cable you can use between network segments without routers. With today's network traffic loads, you're likely to introduce routing before you meet the cable limitations.



take precedence over state and federal codes.

Here are some things to watch for.

- The EIA/TIA 568A standard recommends installation of two four-pair UTP cable drops per work area outlet. One must be at least Category 3, and the other must be Category 5, STP, or multi-mode fiber.
- Category 5 cable for the horizontal drops (cable embedded in walls and ceilings from TC to WAO) can support up to 100 Mbps (Fast Ethernet) and 155 Mbps (ATM).
- Backbone links for the work-group hubs and switches in the TCs can either be Category 5 UTP (limited to 100 meters in dis-

and all telecommunication racks within the building are connected to a dedicated ground via No. 6 insulated green wire ground. It is not acceptable to use water pipes anymore, and this standard is very specific regarding what must be done.

Qualified contractors will be pleased that you can ask the right questions. And you'll feel more confident that the contractor you select will meet your cabling infrastructure needs for a long time. **PC**

John Lewis is senior technical editor of Cabling Business Magazine and a contributing editor of the Association of Cabling Professionals.

Basic Cable Specs

	Category 5 UTP	Multimode fiber
Maximum bandwidth	155 Mbps	622 Mbps
Maximum distance	100 meters	2,000 meters
Connector type	RJ-45	SC or ST
Cost per drop*	\$100-\$150	\$175-\$260
Test method	Category 5 tester	Light sources and power meter

* Cost of 150 feet of cable plus hardware, labor, and testing

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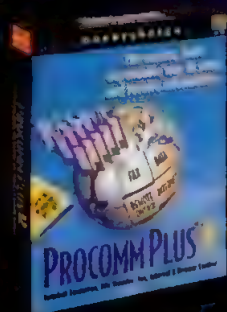
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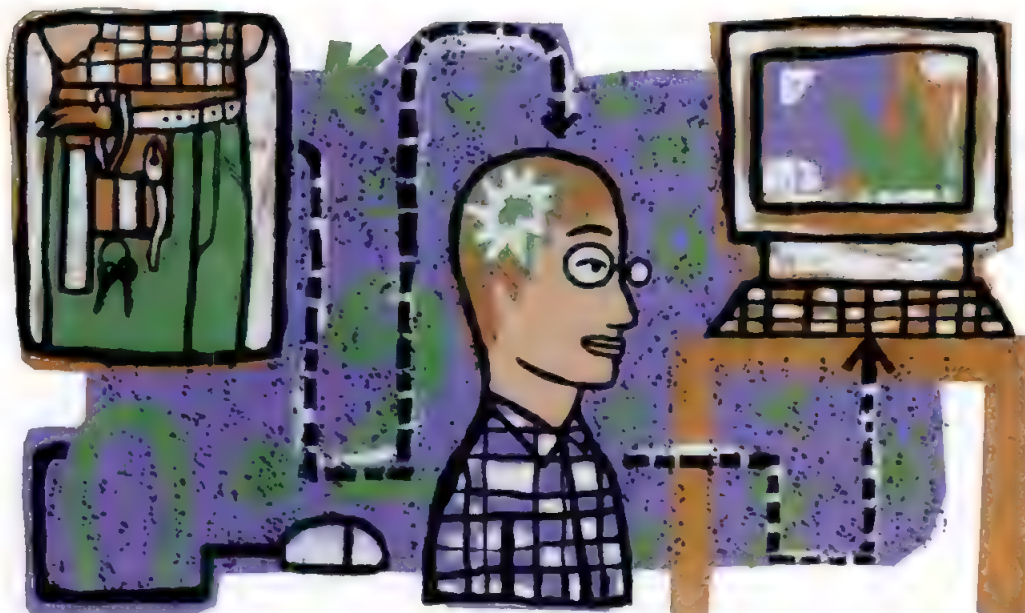
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PC Tech



Installation Toolkits

We look at five packages that give developers a quicker way to produce professional-looking installation programs.

By Steven E. Sipe

In the early days of Windows development, an installation program was a necessary evil that some unfortunate member of the development team would eventually be forced to create. Custom installation programs were usually written in thousands of lines of Visual Basic or C code. The developer generally spent a majority of time debugging the installation process and writing code to handle special-case situations, such as full disks or the lack of write permission on the target drive. Because of the large time investment and extensive development effort required to create complex installation programs, some companies opted for the quick-and-dirty approach to installing their products, using a handful of batch files.

Unfortunately, the companies that did develop custom installation programs often wrote them around the requirements of one particular product. That meant developing a new installation program for each new product and sometimes a completely new installation program for newer versions of the same product.

Fortunately, just as the new generation of Windows development tools has accelerated the development of Windows applications, the new generation of installation tools has accelerated the development of installation programs. These new tools generate installation programs that handle many of the mundane tasks, such as checking for disk space and checking write permission on target drives. They also offer a wealth of features that give your application a professional look and feel. For instance, they provide a nice graphical interface that includes some type of wizard positioned on a backdrop screen on which you can display your own graphics, such as a company logo.

The new tools also furnish another important feature—a way to uninstall your product. Users now expect that in a Windows software product. They also expect your installation program to have a professional appearance (the batch-file days are over) and to perform smoothly. A poorly designed or poorly performing installation program can destroy a user's enthusiasm for your product right off the bat.

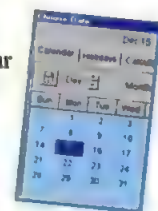
INSIDE

TUTOR: SCSI offers speed and the ability to attach a plethora of devices such as CD-ROM drives, hard disks, scanners, and printers, internally as well as externally. *Page 247.*



▲ OPERATING SYSTEMS: Windows 98 may not be here yet, but you can take advantage of many of its enhancements right now, through a free download from Microsoft's Web site. *Page 255.*

UTILITIES: Our Screens utility lets you schedule appropriate screen savers to be activated automatically on certain days of the week, on anniversaries, or on holidays. *Page 259.*



PC SOLUTIONS: Why double-clicking on a desktop icon may produce more results than you bargained for; the advantages of putting more than one hard disk into your system; customizing keyboard shortcuts and commands more easily in MS Word 97; and more. *Page 273.*



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PC Tech Online
 All files mentioned in this section are available for downloading from our Web site

Each of the packages in this roundup provides the necessary tools to help you quickly develop sophisticated, professional installation programs. Each also provides many advanced features, such as integrated uninstallation. The tools replace yesterday's thousands of lines of program code with visual design interfaces and, in some cases, a fourth-generation scripting language providing built-in functions designed to handle the various aspects of installation. A couple of the packages even delve into a new era of program installation by allowing you to develop installation programs that work across the Internet or your company's intranet.

Each product has strengths and weaknesses. All provide the core set of features necessary for building professional-quality installers. InstallShield Express should suit your needs if you're looking for an easy-to-use, reasonably priced package that supports many different development tools. If you're a Visual Basic developer looking for a solid package at a bargain price, then Setup Wizard should fill the bill.

At the higher end of the price spectrum, InstallShield Professional and the Wise Installation System, Enterprise Edition, provide many advanced capabilities. They let you customize your installation program by using their advanced scripting languages. But keep in mind that these advanced capabilities require a steeper learning curve.

InstallShield Software Corp.

InstallShield Express, InstallShield Professional



InstallShield Software Corp. has been producing installation tools for many years. Its flagship package, InstallShield Professional 5 (\$795 list), clearly demonstrates the company's maturity. InstallShield Express 2 (\$245 list), a more recent addition to the company's lineup, is a more advanced ver-

sion of the free package—InstallShield—that is bundled with many popular development tools. Like its older sibling, InstallShield Express demonstrates the company's expertise in producing solid, full-featured installation programs.

To create a new project with InstallShield Express, you select *Create a New Setup Project* in the InstallShield Express wizard. The New Project screen lets you choose your development platform, a fairly extensive list that includes Borland C++ and Delphi, PowerSoft's Optima++ and Power++, Microsoft Visual Basic and Visual C++, and "generic Windows." It also lets you choose your lan-

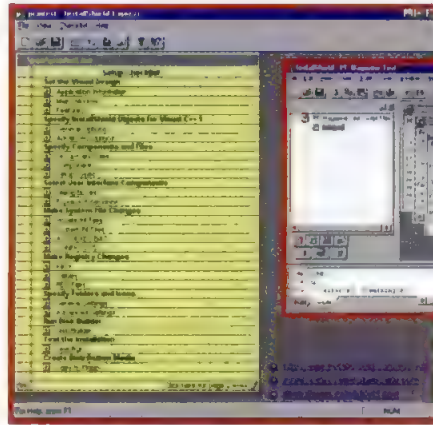


FIGURE 1: InstallShield Express's worksheet project window.

guage; options include English, French, German, Spanish, and others. When you've finished selecting options, click the *Create* button to generate your new project.

InstallShield Express gives you a nice graphical checklist of project options (see Figure 1). To change an option, simply click the button next to it, and a red check mark appears in the outline. The check marks provide a quick way to see which options you've changed as well as those which you may still need to change.

InstallShield Express also provides automatic configuration of external components

such as BDE, DAO, MFC, and ODBC. For instance, to add DAO support to a project, just check the *DAO/Jet* check box under the *General Options* checklist item. Other types of support include the ability to add or update registry entries, create .ini files, and modify Autoexec.bat and Config.sys.

Each of InstallShield Express's features is detailed in the user's guide, which is well written and—surprisingly, considering the package's price—the most extensive of the manuals furnished with the tools in this roundup.

INSTALLSHIELD PROFESSIONAL

InstallShield Professional, at the higher end of the installation package spectrum, provides

support for even more development tools than InstallShield Express. Its user interface is different from its sibling's (see Figure 2). InstallShield Professional looks like the Visual C++ Integrated Development Environment (IDE); the accompanying documentation even refers to InstallShield Professional as an IDE. If you are familiar with development tools like Visual C++, you'll feel right at home with InstallShield Professional. But if you've moved up to the professional version from the less powerful InstallShield Express, you might be disappointed in InstallShield Professional's user interface and in the documentation as well. The manual is one of the smallest and least detailed we encountered in this roundup. The manual's skimpiness is especially surprising given the extensive guide accompanying the less powerful and considerably less expensive InstallShield Express.

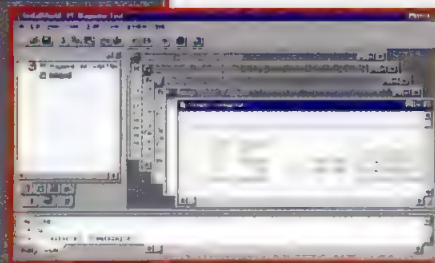


FIGURE 2: InstallShield Professional's Integrated Development Environment.

InstallShield Express. The manual's skimpiness is especially surprising given the extensive guide accompanying the less powerful and considerably less expensive InstallShield Express.

INSTALLATION UTILITIES

YES NO	Supported platforms	Scripting language	Uninstall capability	Supported distribution media	Lists files necessary for MFC/OWL/VB component support	Installs ODBC/DAO components	International language support
✓	Win 95, NT, 3.x	✗	✓	Disk	✓✓✓	✓✓	✓
✓	Win 95, NT, 3.x	✓	✓	Disk, CD	✓✓✓	✓✓	✓ (via add-on)
✓	Win 95, NT	✓	✓	Disk	✗✗✗	✓✓	✗
✓	Win 95, NT, 3.x	✗	✓	Disk, CD	✗✗✗	✓✓	✗
✓	Win 95, NT	✗	✓	Disk, CD	✗✗✗	✓✓	✗
✓	Win 95, NT, 3.x	✓	✓	Disk, CD	✗✗✗	✓✓	✓
✓	Win 95, NT, 3.x	✓	✓	Disk, CD	✗✗✗	✓✓	✓

Editors' Choice

- Basic: InstallShield Express 2
- Advanced: InstallShield Professional 5



The packages in this roundup fall into either of two categories, the first consisting of visual tools that let you

create basic installation programs simply by pointing and clicking, and the second including tools that let you create sophisticated programs using built-in scripting languages. Since there is a clear distinction between the two categories, we name an Editors' Choice from each.

The strength of the visual tools is that they let you create professional-quality basic installation programs quickly. Although each of the tools in this category contains unique features, InstallShield Express 2 represents the most complete solution. The package's memo-

pad-style user interface presents a concise view of your program's configuration options in a manner that makes them accessible but not overwhelming. InstallShield Express also provides support for a variety of programming tools (Delphi, Visual Basic, Visual C++, and others) and provides automatic installation of components such as DAO, MFC, and ODBC. The manual is very well written and guides a user easily through each step of creating an installation program. And the program's relatively low price (\$245) is an added bonus.

Tools that include a built-in scripting language are more complex, but they offer added flexibility, allowing you to customize many aspects of your installation program by writing a script. In this category, we chose InstallShield Professional 5 (\$795). Like its younger sibling, InstallShield Professional provides support for a wide variety of programming tools and components. The sophisticated and fairly comprehensive scripting language lets you tailor your installation program to your needs. The user interface is not as friendly and intuitive as InstallShield Express's, but it should be familiar to programmers using tools such as Delphi, Visual Basic, or Visual C++. InstallShield Professional's online help should provide adequate answers to most script-related questions, but the printed manual leaves a little to be desired.

Although you may find the documentation less than adequate, you won't be unhappy with InstallShield Professional's performance. The Project Wizard guides you through building a new setup program. Your first step is to indicate the development tool you are using along with various other options, such as your product's title and your company's name. Next, you choose the types of screens your installation program will display. You can display a welcome message or a license agreement.

Once you've selected these options, you can specify the Windows platforms your installation program targets. The wizard then presents several more screens letting you configure various options such as language (English is the only one provided with the base package) and installation types, such as compact, typical, or network. When you've finished with these steps, you click the *Finish* button to have InstallShield Professional generate your new project.

InstallShield Professional uses a combina-

tion of visual lists and a C-like scripting language to allow you to configure your project's options. For many items, you select options from various list boxes. InstallShield Professional uses your settings to generate the appropriate scripting language commands, and you can make changes by editing the script.

InstallShield Professional provides many advanced features, including the scripting language. Keep in mind, though, that although the scripting language is C-like, it's not C, and it will require some learning time even if you're already familiar with C.

If you're looking for a solid, easy-to-use installation package that enables you to generate professional-quality installation programs quickly, either of these packages should fill the bill. InstallShield Express will suit your needs if your product doesn't require a lot of custom installation options. It provides a simple, intuitive user interface that guides you gently through each step of creating your installer. It helps you produce a professional-quality installation program with minimal effort. It also provides excellent documentation and a broad range of support for various development tools and languages. If you need more sophisticated installation options, then InstallShield Professional might better suit your needs; just keep in mind that its scripting language requires some effort to learn.

InstallShield Express 2. List price: \$245. **InstallShield Professional 5.** List price: \$795. InstallShield Software Corp., Schaumburg, IL; 800-374-4353; www.installshield.com. Choose 500 at www.pcmag.com/infolink.

20/20 Software Inc.

PC-Install

We looked at a prerelease version of 20/20 Software's PC-Install 6.0 (\$199 list). PC-Install has a simple user interface consisting of a list of project options, a detailed list of information for the current option, and an area to make changes to the selected item in the detail list (see Figure 3). To configure an option, you select it in the detail list, then make changes in the edit area in the bottom pane of the main window.

The Installation Magician guides you through the steps of creating a new installer, collecting information such as the default directory, program title, and program files to install. Once you've entered these options, you can click the *Build* button to generate your distribution media. PC-Install gives you the ability to generate various floppy disk sizes as well as single-file extractions—single executable files that automatically decompress and install the rest of the files in the package. PC-Install also supports the generation of files that can easily be downloaded using a standard Web browser. The Internet output option produces a set of compressed files that can be downloaded from a hyperlink on your Web pages.

Like some of the other tools in this roundup, PC-Install provides support for scanning Visual Basic projects to find dependencies. But—again like some of the other tools reviewed—PC-Install doesn't provide the same functionality for other development tools. That means you're left with the tedious task of collecting all the proper DLLs for such components as DAO, MFC, and ODBC.

Overall, PC-Install performed well, but it ex-

Compresses disk images

✓
✓
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✓

Checks system requirements

✗
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✗

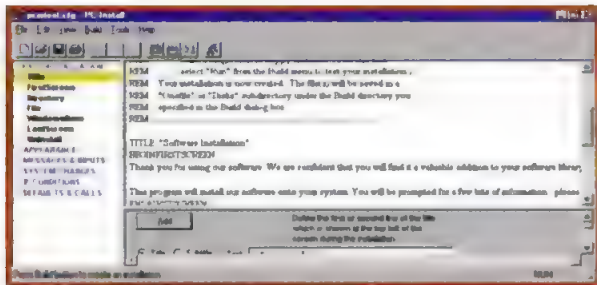


FIGURE 3: PC Install's main project window, with an item list and edit list.

hibited some of the rough edges indicative of prerelease software—a few misspelled words, no printed manual, and minimal although adequate online help. The program's user interface is somewhat awkward and requires a little more time and effort to configure and generate a basic project than the other tools in this roundup, and pressing the F1 key for help occasionally resulted in an error message stating that the help file could not be located.

PC-Install 6.0. List price: \$199. 20/20 Software Inc., Beaverton, OR; 800-735-2020; www.twenty.com. Choose 501 at www.pcmag.com/infolink.

Indigo Rose Software Design Corp.

Setup Factory

Setup Factory 4.0 (\$230 list) is easy to use; its user interface consists mainly of a list control (see Figure 4). The program supports many of the standard features required for installing Windows products, such as whether to replace a file based on its date. Setup Factory also offers some advanced features. Most notably, it provides a way to configure your installation to check for minimum system requirements. For instance, your installation program can verify that it is running on the right Windows platform and that the system contains the necessary amount of available memory and hard disk space. You also get a couple of options for handling cases where requirements aren't met—you can abort the installation, for example, or continue with a warning.

Creating a new installation program with Setup Factory is very straightforward. When you start the program, it presents you with the Project Wizard, which guides you through the basic steps of defining your installation program's characteristics. The first step allows you to set the title of the program and the copyright information (this information will be displayed in your installation program's background screen). Next, you specify a

source directory, and the Project Wizard automatically adds the directory's filenames to the installation file list. Finally, you configure the default directory where your program should be installed, along with the default program group name. Once you are satisfied with these options, you click the *Finish* button, and Setup Factory generates your new project.

When the project generation is complete, Setup Factory gives you the option of scanning your Visual Basic project to generate dependencies. This very useful feature allows you to configure, for instance, components such as DAO and ODBC. It automates the process of determining which runtime and support files your program requires. Unfortunately, Setup Factory provides this feature only for Visual Basic, which leaves developers using other tools to determine dependencies manually. If you're developing Visual C++ applications, for instance, you're forced to use the tried-and-true (but error-prone) method of manually adding the DLLs necessary to support DAO and MFC.

Setup Factory allows you to configure many advanced project options, such as adding or modifying Registry keys, displaying a license agreement, or displaying a Readme.txt file after installation.

When you've finished choosing project options, you can choose the *Create Master Disk Set* menu item to generate your product's in-

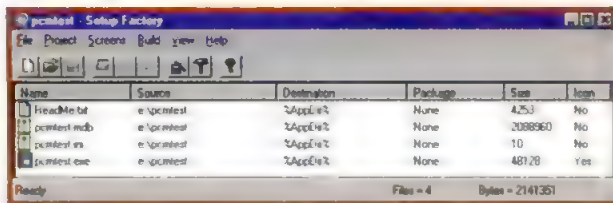


FIGURE 4: Setup Factory's project window.

stallation disks. Building disks is fairly simple, but the process is somewhat flawed. Setup Factory's disk builder tool is treated as a separate program and gives you the feeling you've left the main program to generate disks. This feeling is further reinforced when you click the *Cancel* button to exit the disk builder, and the tool displays a message asking whether you're sure you want to exit. The question is disconcerting if you don't look closely, because it seems to indicate that you are exiting Setup Factory, rather than the disk builder.

In spite of the quirky disk generation process, Setup Factory performed well and provided a simple way to produce a professional installation program, especially if you are devel-

oping Visual Basic applications. If you're using another development tool, you might want to look at some other packages that provide broader support for other development tools. **Setup Factory 4.0.** List price: \$230. Indigo Rose Software Design Corp., Winnipeg, MB, Canada; 800-665-9668; www.indigorose.com. Choose 502 at www.pcmag.com/infolink.

Sax Software Corp.

Setup Wizard

Sax Software Corp. has received praise for years among Visual Basic developers for providing solid add-on components for Visual Basic. Likewise, Setup Wizard has garnered recognition and praise for its simplicity and ease of use. Version 2.0 of Setup Wizard (\$149 list) is an easy-to-use tool that provides the basic features necessary for building professional-quality installation programs. It presents your project options in a simple list fashion (see Figure 5) and allows you to change or add new options using toolbar buttons or menu items.

The Project Wizard guides you through the necessary steps of generating a new project. It provides the same basic features as most of the other wizards in this roundup, including the ability to set your program's title, default directory, and list of files. Setup Wizard also offers one feature none of the other packages provide: It can scan a specified executable and determine which external DLLs and OCXs the file requires. This feature comes in handy when you're building installations for programs that use several types of external components, such as DAO, MFC, or the Visual Basic runtime DLLs.

You can configure your project's various options by selecting them individually in the project option list. You can also add new options by clicking the *Insert* toolbar button (or selecting the menu command). The process of adding and modifying project options is very straightforward, but Setup Wizard's user interface is sometimes a little quirky. For instance, you can delete a selected item in the options detail list using the *Del* key (or the *Delete* toolbar button), but the list allows you to select only one item at a time. To complicate things further, the selection in the list disappears along with the deleted item, so there aren't any items selected in the list after you delete one. That means you have to use the mouse to select each item you want to delete, instead of being able to press the *Del* key repeatedly to remove a series of items. The process is tedious if you need to remove a lot of items.

After you've configured your project options, you can bring up the Disk Wizard to help you generate your distribution media. The

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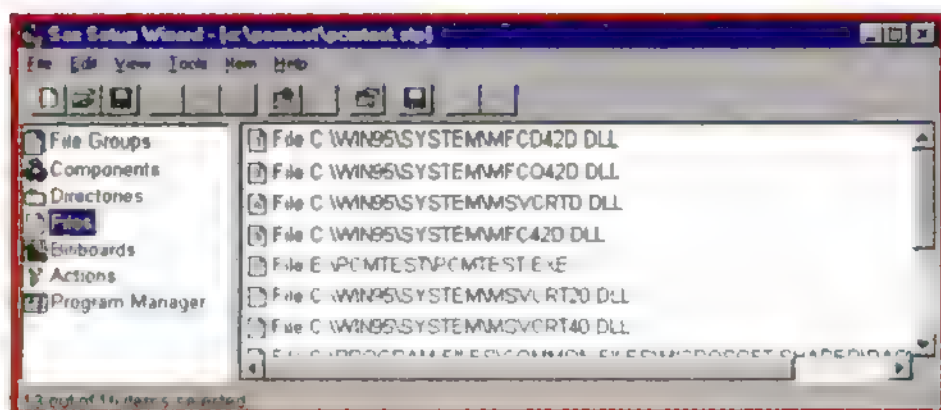


FIGURE 5: Setup Wizard's project windows, with a list of selected files.

Disk Wizard provides several output options, including the usual floppy disk sizes as well as CD-ROM and even e-mail. Generating disks is simple and straightforward. When the process is complete, you are presented with the option of testing your new installation immediately, giving you a quick way to verify that your new installation program performs as desired.

Setup Wizard provides a minimal but usable manual, which describes how to generate a new project and configure its options. It also provides a handy list of the variables that Setup Wizard uses during installation. These variables represent items such as the target installation directory, Windows directory and the common program files directory. The list can come in handy when you are adding new files to your project, since you will most likely use one of the variables to specify the file's target location.

We found that Setup Wizard performs as advertised and provides a fairly simple way to produce professional-quality installation packages. It doesn't provide a large amount of advanced configuration options, but it does offer some nice advanced features, such as the ability to scan an executable file and determine its dependencies. The user interface is fairly simple, though sometimes a little quirky. If you're looking for a good basic installation package at a low price, then Setup Wizard should fill the bill.

Setup Wizard 2.0. List price: \$149. Sax Software Corp., Eugene, OR; 800-645-3729; www.saxsoft.com. Choose 503 at www.pcmag.com/infolink.

Great Lakes Business Solutions Inc.

Wise Installation System; Wise Installation System, Enterprise Edition

Great Lakes Business Solutions sells two editions of its **Wise Installation System 5.0**: the basic system (\$195 list), which contains the installation program development tool, and the **Enterprise Edition** (\$595 list), which also contains several add-on tools. The add-ons include **SmartPatch**, which helps you produce upgrade installations that replace only the parts of your product that have changed.

Another tool, WebDeploy, helps you produce Web-based installations. A third tool, SetupCapture, creates customized installation programs by using something similar to an installation template.

The user interface in both consists of a wizard (see Figure 6), which allows you to configure basic project options. To generate a new project, you

begin by configuring the same types of items we've seen in the other installation packages: the product's name, its default directory, and a list of its files. You can also select the *Runtime Components* option to specify which add-on components your project needs. Unfortunately, the primary support provided for component configuration is aimed at Visual Basic programmers. For instance, the only mention of DAO is in the context of installing DAO/Jet support for Visual Basic. Surprisingly, though the product is a little weak on such things as DAO support, there seems to be a high level of support in all configurations for BDE. In general, if you're a Visual Basic developer, Wise Installation System makes it easy to configure options, but if you're using other development tools, you're stuck with manually configuring the various components.

For more advanced project configuration, you can switch to the script editor and customize various aspects of the installation process using the built-in BASIC-like scripting language. This feature is especially nice if your product requires advanced installation options, such as updating .ini files or adding Registry information. Keep in mind, though, as with InstallShield Professional, the scripting language may take some time to learn. Wise Installation System does ease the learning curve somewhat by providing a list from which you can select common operations. To add a new operation, you just click on the item. For example, you can add a function to check the amount of free space on your target disk by clicking on its corresponding list item. Wise Installation System will generate the required script command, and then it's up to you to fill in the specifics (for example, how much free disk space your installation requires).

Like some of the other products in this roundup, Wise Installation System provides support for multilingual installation programs. In fact, it includes support for an impressive 15 languages and allows you to use any of the supported languages simultaneously in the same installation program.

Once you've configured your project options, you can test your new installation by clicking the *Test Installation* button on the project wizard screen. This option runs a simulated version of your installer (no files are actually installed), which allows you to perform a quick check of your installation program's user interface without affecting your system.

When you're satisfied with your program's configuration, you can produce the distribution media by clicking the *Distribute* button. The type of distribution media you can produce (that is, the disk size and disk drive) is based on the media type you selected in your project's options. We found that the media generation process was straightforward and worked well, but selecting the media type based on project options was a little less convenient than being able to the media type directly from the disk generation tool.

The Wise Installation System user's guide is adequate, but somewhat minimal. It covers a fairly broad range of subjects but doesn't provide much depth. The documentation stacks up well against the manuals provided with other products in this roundup but doesn't measure up to the InstallShield Express manual.

Wise Installation System and Wise Installation System, Enterprise Edition, are both solid packages that provide many advanced features. If you want a fairly low-priced, flexible package that can handle custom installations, and if you

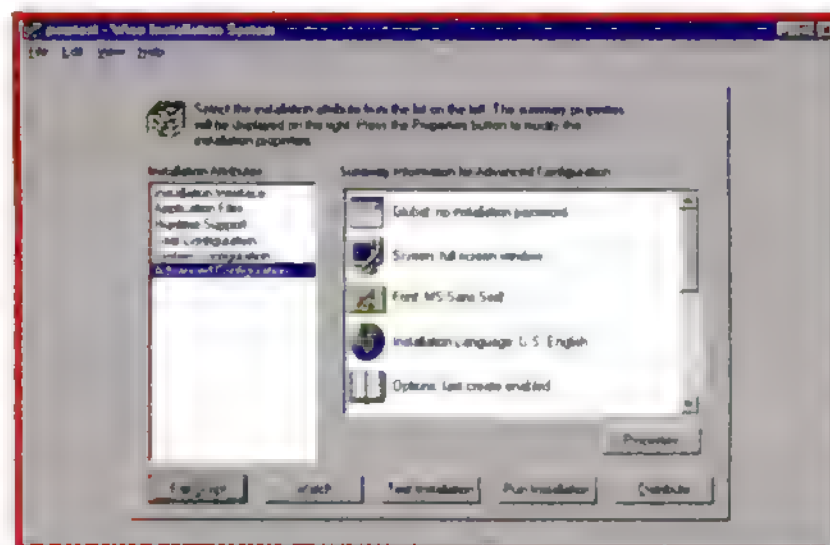


FIGURE 6: *Wise Installation Sytem's Project Wizard.*

don't mind learning a scripting language, then the basic Wise Installation System should suit your needs. If you're looking for more advanced features, such as the ability to produce Web-based installations, then you might find it worth the extra cost of the Enterprise Edition. **Wise Installation System 5.0.** List price: \$195. **Wise Installation System 5.0, Enterprise Edition.** List price: \$595. Great Lakes Business Solutions Inc., Canton, MI; 800-554-8565; www.glbs.com. Choose 504 at www.pcmag.com/infolink. **PC**

Steven E. Sipe is a developer based in Wilmington, North Carolina, and the author of the recently published PC Magazine utility ZD Desk.

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SCSI Just Keeps On Rolling

We examine the process by which the SCSI interface transfers data among SCSI devices.

By Neil Randall

Other hardware interfaces come and go, but SCSI (small computer system interface) seems to go on forever. Like the more familiar IDE (integrated drive electronics) and EIDE (Enhanced IDE), SCSI (pronounced "scuzzy") provides a standard means for computers to exchange data among hardware devices such as disk drives and CD-ROM drives.

Some PCs ship with SCSI interfaces built onto the motherboard. In most cases, however, you have to install a SCSI host adapter card. These devices are readily available from computer stores and are no more difficult to install than any other peripheral card. When you boot with a fully installed SCSI card, you'll see a set of new boot-up messages indicating that the BIOS for the SCSI interface is starting. The SCSI BIOS is separate from your computer's BIOS and allows the newly installed SCSI bus to exchange data with the CPU and other SCSI devices.

SCSI's most obvious strength is the number of devices it can control. Where IDE interfaces were restricted to two disk drives and today's EIDE interfaces are restricted to four devices (including hard disks and CD-ROM drives), a single SCSI controller can handle up to eight devices (including the host adapter card, which counts as a device). Furthermore, the devices can vary from hard disks and CD-ROM drives to compact disk-recordable units, scanners, printers, optical drives, and more. High-end servers frequently use a SCSI interface exclusively, in large part because of its easy expandability. But the exclusivity is unnecessary. IDE/EIDE and SCSI interfaces can be freely combined inside a PC, offering expanded possibilities for hardware configuration. In PCs,

the SCSI host adapter takes up a hardware interrupt (IRQ), but the devices attached to the card do not, which significantly increases expandability. In fact, it's possible to add a second SCSI card for 7 additional devices. Better still, a "twin-channel" SCSI card takes up only one IRQ and handles 15 peripheral devices.

SCSI FLAVORS

Although it's considered a single standard, SCSI actually comes in a variety of types. Among these are SCSI, SCSI-2, SCSI-3, Fast SCSI, Fast/Wide SCSI, Ultra SCSI, Wide Ultra SCSI, Ultra2 SCSI, Wide Ultra2 SCSI, and more. The latest specification is SCSI-3. I'll explain the differences among the different versions very briefly, and I'll spend the rest of this column detailing the process by which the SCSI interface transfers data among devices.

the interface was and still is the set of commands that control data transfer and communication among devices. The commands were the strength of SCSI, because they made the interface intelligent; but they were also its initial weakness, because there wasn't enough of a standard for the command set to be truly useful to device manufacturers. So the Common Command Set (CCS) was developed to standardize SCSI commands and was accepted as an extension to SCSI.

With the SCSI-2 specification (completed in 1990 and adopted in 1992), the standard moved into its role as a multiple-device interface. Instructions were added for new equipment classes, including CD-ROM drives, optical drives, media changer devices, printers, communications devices, and more. SCSI-2 also introduced two important performance options, Wide SCSI and Fast SCSI. Wide SCSI offered 32-bit transfer by adding a second cable (called a *B-cable*) between device and adapter. Fast SCSI increased the synchronous-mode clock frequency to 10 MHz, thereby doubling the data-transfer rate to 10 MBps. Combining these options produced Fast/Wide SCSI,

whose transfer rate jumped to as high as 40 MBps. SCSI-2 also incorporated CCS instructions and added numerous others to allow effective control of new device types. SCSI-3, the most recent, predicts speeds of more than double that of SCSI-2.

The SCSI-3 specification (drafted in 1996) splits SCSI into a number of standards. These include the Parallel Interface specification, which governs the workings of SCSI cables; the Architectural Model, defining the instructions needed to implement a data transfer; the Primary

Commands specification, which sets out the commands for all SCSI devices; and specifications for device types. SCSI-3 also eliminates the need for a second cable for Fast SCSI or Wide SCSI, adds support for fiber-optic cable, and adds new instructions to the command set. SCSI-3 is less of a dramatic departure from SCSI-2 than SCSI-2 was from the

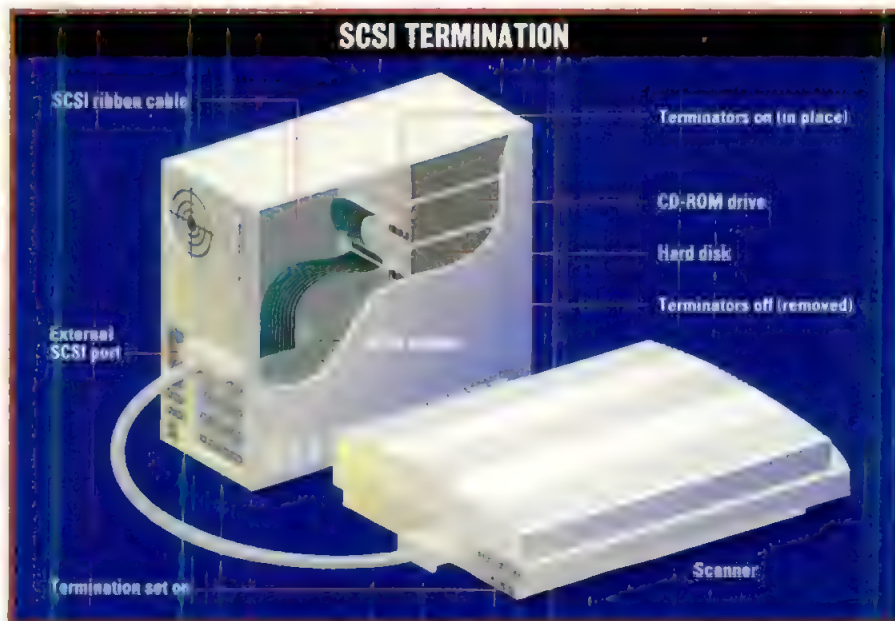


FIGURE 1: This shows how to set the terminators on your devices when you have more than one internal device and an external device. The SCSI bus must contain two terminators and no more than two.

The original SCSI specification, completed in 1986, established a hardware interface for connecting disk drives to computers. The SCSI bus transfer rate in its standard asynchronous (or handshake) mode was roughly 3MB per second over an 8-bit bus. In synchronous (or streaming) mode, the SCSI bus was able to perform at more than 5 MBps. The basis of

original SCSI, but the new standard signals a further maturing of the technology.

TARGETS AND LUNS

The SCSI specification defines both the details of the SCSI bus and the protocol by which data transfer takes place between devices. A SCSI device has a built-in controller that interprets commands from the host adapter, much like an IDE or EIDE drive, which interacts with the IDE adapter card. But SCSI adapters are more complex than IDE adapters, because the latter rely on the CPU for functions such as data transfer between devices. The SCSI adapter, on the other hand, knows all the possible SCSI commands and doesn't depend on the CPU for any of them. That's why it's a good idea to upgrade your SCSI adapter if you buy a new SCSI device with a built-in controller that supports the latest SCSI version. For the most part, devices are backward-compatible, but their efficiency and feature sets may well rely on the ability to interpret the newest SCSI commands, which your old host adapter might not understand.

SCSI was designed as a parallel interface that allowed as many as eight devices to be connected along a single cable. The cable and the host adapter form the SCSI bus, which operates independently of the rest of the computer. The bus allows data exchange among devices without taking up CPU cycles and thus without relying on the system bus. That makes the SCSI bus's potential speed higher than that of the bus for interfaces such as IDE, which at least partly rely on the system bus. Tape backups, for example, from a SCSI hard disk to a SCSI tape drive can perform extremely well in the background, if the backup software is designed for full SCSI support. Anything that demands CPU and system bus activity, however, requires interaction between the SCSI host adapter and the system.

Through the SCSI BIOS, each device is given a distinct address or SCSI ID, ranging from 0 to 7 for a narrow (8-bit) bus or 0 to 15 for a wide (16-bit) bus. Devices that request I/O processes are called *initiators*. Devices that perform operations requested by initiators are called *targets*. Through its built-in controller, each target can accommodate up to eight other devices; these are known as *logical units*, and they are each assigned a *logical unit number*, or LUN. Commands to the SCSI controller identify devices according to their LUNs; the controller connects to the SCSI bus and executes the commands.

Each SCSI address is a target, and since each of these targets is also a SCSI device

with its own controller, it can assign addresses to additional SCSI devices. In most simple systems, the host adapter card—which is the first target in the system—acts as a controller for itself and 7 (or 15) additional SCSI addresses. Let's say it's controlling a hard disk, a CD-ROM drive, and a scanner. The hard disk would be assigned SCSI ID 0, the CD-ROM drive SCSI ID 1, and the scanner SCSI ID 2. The LUN for each of these addresses would be 0, since the devices (the logical units) are all closed, single-function hardware devices. So SCSI ID 0 controls the hard disk and assigns it LUN 0, since the disk is the

The SCSI bus allows data exchange among devices without taking up CPU cycles and thus without relying on the system bus.

first and only logical unit on that particular address. SCSI ID 1—a completely separate address—assigns LUN 0 to the CD-ROM drive, because the CD-ROM drive is the first and only logical unit on that address. And so on. Each of these SCSI IDs is capable of controlling more devices (LUN 1 through LUN 7). With closed, single-function devices such as disk drives, however, this capability lies completely unused. One of the goals of SCSI developers and manufacturers is to create products that can make use of this wasted capacity, primarily through a *bus bridge*, a two-port device that connects to the main SCSI bus and creates an auxiliary bus to which additional logical units can be attached.

HOW SCSI WORKS

The SCSI bus requires *termination* at both ends. Typically, the host adapter is one end of the chain, and the final device on the SCSI cable is the other. Terminating means leaving a resistor connected on the circuit board (which is often a matter of leaving a jumper in place). If you have an adapter and only one device (a CD-ROM drive, for instance), termination is easy: The resistors are in place with each SCSI unit as it ships, so you don't have to do anything. As you add devices to the bus, however, you must remove the terminator from all but the first and last one. This gets a bit more complex when you com-

bine external and internal SCSI devices. A host adapter card typically has an external port that lets you attach devices such as a scanner or an external CD-ROM drive (see Figure 1). As long as you have only one device attached, you have no problem: The host adapter forms one end of the bus, and the external device forms the other. But if you have at least one internal device on the bus, you must remove the terminating resistor (terminator) from the adapter itself, allowing the last internal device to form one end and the external device to form the other. The bus must contain two terminators but no more than two.

Each SCSI unit on the bus can take control of the bus, as an initiator, by transmitting control signals (commands) aimed at a specific target. When SCSI was introduced, only one command per logical unit could be sent at a time, but SCSI-2 introduced command queuing, in which up to 256 commands per initiator can be queued for each logical unit. Furthermore, the target's controller is able to analyze the queue and change the sequence for greatest efficiency. One of the essentials of SCSI design is that initiating devices should use the SCSI bus only for transmitting commands and data, leaving the bus free for other devices whenever data is not being transferred. If a command is cached on the target controller, for instance, and pertains only to that target controller, the controller won't use the bus at all until there's a need to transfer something. This system requires careful coordination of commands and transfers; hence the importance of increasing intelligence in the controllers.

The transfer of data or control signals over the SCSI bus takes place in eight phases. The first is the *bus-free* phase, where the initiator determines that the bus isn't under the control of another SCSI device. In the next phase, *arbitration*, the initiator sends a control signal to set the bus into a *busy* state and sends its own ID number out to the bus, effectively stating that it wishes to take control. A short delay then occurs, during which other devices can send the same signal and the bus arbitrates, giving the device with the highest ID number the go-ahead. If no other device asks for the bus, or if the original initiator has the highest ID number, then the original initiator controls it.

Once the device has the bus under its control, the process enters the *selection* phase, possibly followed by the *reselection* phase. In the former, the initiating device specifies a target unit and sends that unit one or more commands. Commonly the device might tell a hard disk to read or write data. When the target re-

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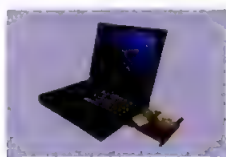
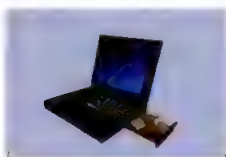
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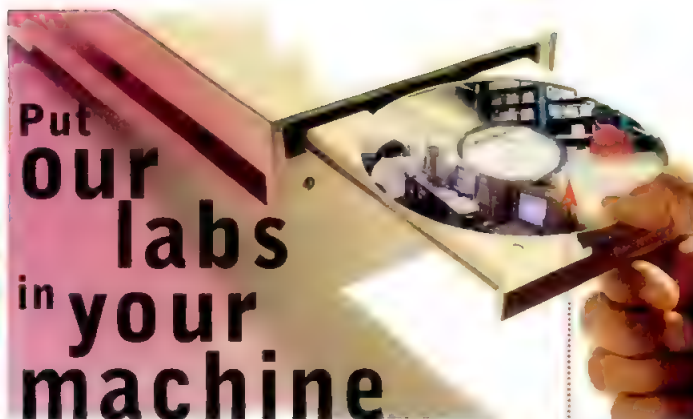
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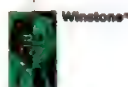
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ceives the command, it sends its ID number onto the bus so that both devices are active. Since only two devices can be active at any given time, the bus becomes unavailable to any other unit. The target recognizes the initiator by its ID number, and the controller stores this information in case of a lost connection between the two. A lost connection can result from an error, but in the case of reading and writing data, the lost connection can also be intended: During drive access (which takes some time), the target releases the SCSI bus so that other transactions can occur. Once the target has completed the command, it enters the reselection phase, during which it recalls the initiator's ID number and essentially repeats the bus-free, arbitration, and selection phases to reestablish contact.

The final four stages are *command*, *data*, *message*, and *status*. During these stages, the target receives commands from the initiator, and the two exchange data and, if necessary, messages concerning the connection and status information about each other. Once the purpose of the connection has been fulfilled, the initiator sends a *reset* control signal and the bus is returned to a bus-free state, ready for other transactions. Note that the CPU doesn't get involved with any phase in the process: Its only interaction is with the host adapter, and only when actual CPU cycles are required.

AND MORE

The SCSI interface is certainly capable and complex. There are many more areas for discussion, but we don't have room to explore them in great detail. For example, there's the ongoing problem of the lack of a truly standard programming interface, which means that host adapters have even more work to do than they otherwise would. The two primary programming interfaces are ASPI (Advanced SCSI Programming Interface), implemented by the SCSI card manufacturer Adaptec, and CAM (Common Access Method), developed by the standards body ANSI. Both allow control over SCSI devices, but they work in different ways. Compatibility is just one of many issues under consideration by SCSI developers. The future of SCSI will see faster data transfer, the ability to control more devices, and a greater exploitation of SCSI's built-in flexibility for an expanding variety of devices. Despite the popularity of interfaces such as EIDE, there's no sign that the development of SCSI is going to slow down. **PC**

Neil Randall is the author of *The Soul of the Internet (ITCP)* and Special Edition Using Microsoft FrontPage 98 (*Que*).

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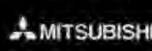


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Upgrade to Windows 98 . . . Before Microsoft Does

Don't wait around for the product to be released—you can enjoy many of the enhancements right now.

By Neil Randall

When Microsoft announced the delay of Windows 98 until the spring of 1998, it was pretty much—as Yogi Berra is supposed to have said—*déjà vu* all over again. After all, Windows 95 was originally to have been released in late 1994, but the product didn't end up on store shelves until August 1995. It's anyone's guess when Win 98 will actually see the light of day.

But there's no need to wait for the new operating system to be officially released to see what it's like, work with its interface, and determine if you'll want it. The main end user components of Win 98 are already available through free download, and if you've bought a PC during 1997, there's a very good chance you have some of the most important under-the-hood components already in place. Thanks to the Internet and the focus it's placed on continual software upgrades, Microsoft has been making Win 98 available in bits, pieces, and very large chunks for well over a year.

Let's start with a few disclaimers, though. First, all the downloads in the world won't get you the real Win 98. We'll show you how to get what's available here, but we'll also give you a sampling of what you can't get without the official upgrade. Second, if you're not comfortable downloading and installing software, don't even start. Some of these downloads are huge, and others are just confusing. And before beginning, back up your important data, and make sure that you have a boot-up disk. There's always a chance that an installation will make your system unusable. So play it safe. Finally, we'd like to give you the impression that this upgrade is somehow stealthy and under-the-table, because that would be exciting and secret agent-like, but it's not. These are easily available downloads, perfectly legal in every way. In one case, though, it's not a download at all, and we'll start with that.

GETTING FAT

Of all the upgrades you can now acquire to move from Win 95 to Win 98, the FAT32 file system is the most difficult to come by. FAT32

replaces the archaic FAT16 file system, improving disk space efficiency significantly. FAT32 ships with Win 95, but only with OSR2, which started to ship in late 1996.

It's not a necessary upgrade, but we mention it first for two reasons. First, it's part of Win 98, so you'll want it if you're interested in coming as close as possible to the new OS. Second, if you're going to upgrade to the FAT32 system, you must do so before you do anything else. The reason is that Win 95 FAT32 forces you to reformat your entire disk and then install Win 95 and all your apps from scratch if you want to install the FAT32 system. OSR2 doesn't come with a conversion utility. Win 98 will contain a one-way conversion utility, but it's not available yet. If you wish to perform a conversion, and you don't mind spending a few extra bucks, PowerQuest's Partition Magic 3.0 will handle the task very nicely.

If you bought a system in 1997, there's a good chance you already have OSR2, and there's even a chance you're already using FAT32. To find out if you're running OSR2,

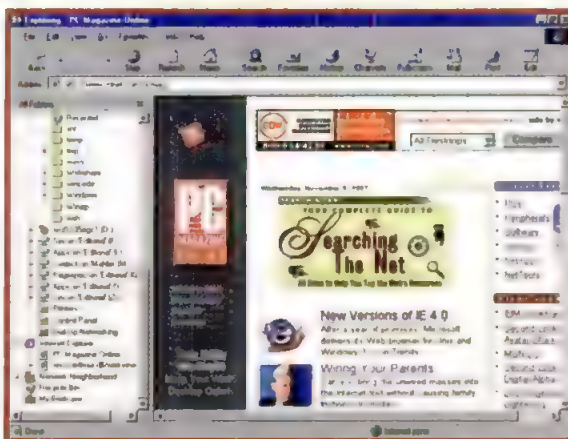


FIGURE 1: In Windows Explorer, the Web sites you visit appear in the left-hand pane.

open the **System** icon in **Control Panel**, click on the *General* tab, and check the information under the heading *System*. If it says, “4.00.950 B,” you’re running OSR2. Otherwise, you’re not. If you are, then check to see if the FAT32 file system has been installed by opening **My Computer**, right-clicking on your primary drive (usually C:), and choosing *Properties*. If

you're running FAT32, the third line of information under the *General* tab will say so.

Note that you don't actually need to use FAT32 to have a Win 98-capable system. Win 98 will still support FAT16. In fact, if you're planning to install Windows NT Workstation or Server as well, and you want to work with your Win 95 files while in Win NT, don't activate FAT32 at all. Win NT 4.0 can't read FAT32-formatted disks, and early reports say that Win NT 5.0 won't be able to, either.

OSR2 users are automatically several steps closer to having Win 98 than users with the original Win 95. That's because OSR2 contains all the enhancements in the Win 95 Service Pack (see below) in addition to several other useful components. We'll cover these in a moment. If you're working with a non-OSR2 version of Windows but your version shows as 4.00.950a (check the System icon in Control Panel again), the Service Pack has already been installed.

If you don't have OSR2, you'll have to spend quite a few bucks to get it: You can usually only buy it along with a new system, although some dealers will sell it to you if you buy a new motherboard. Check with your local dealer to see how you might get it, and insist on getting it free if you're buying a complete new system. If you have to spend money on it, it's probably not worth your while at this point.

SERVICE COMES IN PACKS

If you decide not to acquire OSR2, you'll want to get Windows 95 Service Pack 1, which contains a number of bug fixes and DLL additions that plug security holes and offer stronger compatibility with printers and apps. One example is an update to OLE32 that helps eliminate problems of unwanted deleted data in files created for Word, Excel, and PowerPoint. Another update solves problems created by Microsoft Plus's System Agent.

To get the Service Pack, go to www.microsoft.com/windows95/info/updates.htm. In fact, you should bookmark this page, because you'll be returning here often. Not only is the Service Pack available from this site, but a wide variety of updates and fixes are available as well. In fact, everything you need for the Win 98 near-upgrade is available from this one area. Start with the Service Pack. Click on *Service Packs* and follow the download instructions.

Once you have the Service Pack installed and your machine restarted, head back to this URL and click on *System Updates*. Download and install the Kernel32 update, the OLE32

update (yep, another one), and the Password List update. All of these fix other Win 95 bugs. If you use Microsoft Exchange, download and install the Exchange update as well. And if you see any other updates you'd like to try, now is the time to get them.

UPDATE! UPDATE!

Even if you don't have OSR2 installed, you don't have to miss out entirely. Several components of OSR2 are available on the Microsoft site. Go back to the updates URL and click on *OSR2 Downloadable Components*. Download and install the following from the Internet and Multimedia area: Internet Connection Wizard, NetMeeting, Personal Web Server, DirectX 2.0, and Active Movie. Then, from the Networking and Communications area, get Voice Modem Support and Infrared Support. Finally, take Wang Imaging for Windows from the Additional Features area. Install them and you're now as close to a full OSR2 installation as possible.

And that means you're closer to Win 98, which contains all of these features. Personal Web Server, for example, is a baby version of Microsoft Internet Information Server (which runs only on Windows NT), complete with FTP services and strong customizability. Without Windows NT's built-in security features, PWS isn't going to be hosting any banking sites, but it's perfect for hosting a small office intranet or for testing your Web creations. The other Internet packages are available with Microsoft Internet Explorer 4.0 as well; but if you download them now, your IE 4 download will be less time-consuming, because you can opt to exclude those packages during the download. Of course, if you get IE 4 on CD-ROM, download time isn't a concern at all.

Some of the available components are upgrades of the ones on the OSR2 CD-ROM. So even if you have OSR2 installed, you should download most of them. A good example is the Dial-Up Networking (DUN) upgrade. It replaces the DUN component that ships with Win 95 and includes a number of important new features. Among these are built-in scripting (formerly available as a separate download or off the Win 95 CD-ROM) and the ability to eliminate the initial Connect screen from the dial-up process. But DUN 1.2 adds two important new features that are part of Win 98. The first is support for Virtual Private Networks, which allow you (through the new Point-to-Point Protocol) to log in over a modem to your company's local area network. The second is support for Win 98's *multilink* feature. With *multilink*, you can use more than one communications device (two ISDN cards or a modem and an ISDN card, for example) with any DUN

connection. The multiple devices work together to offer faster data transfers.

Promised to be available soon from the OSR2 Downloadable Components page (possibly by the time you read this) are enhancements for Display Settings and OpenGL. The former lets you change color depth without rebooting, a feature currently available only with the proprietary software that ships with video cards or through the downloadable Microsoft "power toy" called QuickRes. The latter enhancement provides libraries for the OpenGL graphics standard, found in an increasing array of products.

AND NOW, THE CLINCHER . . .

Okay, so far it's been easy, and pretty un-dramatic. To bring your system as close as possible to Win 98, you'll need a brand-new interface and a completely new model for interacting with networks. You'll need, in other words, Internet Explorer 4.0. Installing IE 4 will do more than anything else to give you a taste of Win 98, primarily because it gives you the Win 98 interface. In fact, even if you install none of the packages mentioned so far, IE 4 will give you a solid taste of the OS upgrade. IE 4 provides you with all the interface enhancements you'll find in Win 98; you could even reason that it represents Microsoft's beta test of the Win 98 desktop.

The central philosophy of the new Windows OS is to make the network—particularly the Internet and intranets—part of the actual interface. To this end, IE 4 and Win 98 include the Active Desktop, on which you can place Web pages or active *channels* (subscribable sites with automatically updated content). In the past, you could put an icon for a Web document on the desktop; now you can put the actual page itself on the desktop. But two far more important changes have resulted from this shift in philosophy. First, you can set up IE 4 and Win 98 to emulate the Web's one-click interface, with a single click on a desktop icon, a folder icon, or a filename in Windows Explorer getting you where you wish to go. The folders themselves are rendered using Dynamic HTML, offering stronger visual and textual clues to your choices.

Because not everybody likes this interface change, IE 4 and Win 98 ship with the older double-click version in place. But from my standpoint, the new interface represents the most dramatic shift in how we use computers since the introduction of the Macintosh OS back in 1984. Tasks are faster to perform, and the interface as a whole makes more logical sense (double-clicking makes sense only on the one-button Mac mouse). The one requirement is that you get used to working with the

right mouse button, which now becomes essential to your work—even more, in fact, than it was in Win 95.

The second major change is the concept of browsing from anywhere. Although IE 4 and Win 98 ship with the Internet Explorer browser, any folder now operates as a Web client. Whether you're in Windows Explorer or the Control Panel, you'll have the option to type in a URL and have the page downloaded into a folder without loading a separate instance of IE. The folder's toolbar changes depending on whether you're looking at local details or items on the Internet or in an intranet, and you can do everything here that you can do in IE proper. In the case of Windows Explorer, the Web sites you visit appear in the left-hand pane along with your local folders and files (see Figure 1), with Windows Explorer treating everything—network or local—as if it's on your hard disk. Ironically, Microsoft is probably closer to Sun's famous dictum "The network is the computer" than Sun is.

THAT'S IT!

With all these installations complete and the Active Desktop turned on, your machine is remarkably close to what it will be when you install Win 98.

As you might expect, Win 98 offers more than just the changes mentioned here. The official release will contain a folder for online services such as URL and CompuServe, as well as a disk defrag wizard that will help you keep your hard disk in an optimum state. Support is included for advanced power management and for recently introduced hardware such as the Universal Serial Bus (USB), the Accelerated Graphics Port (AGP), and DVD. A scripting host lets users automate the OS's features, and several utilities help you diagnose your system. One extremely interesting feature allows your computer to function with multiple displays (4 initially, 16 eventually), useful for demonstrations, large spreadsheets, and CAD/CAM applications.

In other words, there's still lots to look forward to. But the heart of any OS is its interface, and you can get that and more now, at no cost (unless you opt to buy OSR2). That's not the only reason to do all this; bragging rights are also at stake. When your colleagues start talking about their new Win 98 systems, you can shrug and tell them you've had Win 98 up and running for months. When they ask how, just tell 'em you know someone in the business. **PC**

Neil Randall is the author of The Soul of the Internet (ITCP) and Special Edition Using Microsoft FrontPage 98 (Que).

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Screens: A Screen-Saver Manager

Schedule screen savers for holidays, special events, and days of the week.

By Neil J. Rubenking

When you come back from lunch or finish a long phone call, you may find your computer's monitor filled with moving lines, bouncing pictures, a scrolling message—even a view from a Web camera thousands of miles away! It's your screen saver, of course, and tapping a key or bumping the mouse will dismiss it. The selected screen saver is activated automatically when a specified number of minutes pass with no keyboard or mouse activity. Screen savers are controlled by the desktop's Display Properties dialog, which is invoked either by right-clicking the desktop and choosing *Properties* or by launching the Display applet in Control Panel. The Display Properties dialog lets you select your favorite screen saver and preview or invoke its configuration dialog. You can also set the wait period—the number of minutes of inactivity before the screen saver becomes active—and control password protection.

Wouldn't it be nice if you could schedule screen savers by the day of the week or special dates such as holidays, birthdays, or anniversaries? For example, you might want to have the marquee screen saver that comes with Windows display "I hate work" on Monday, "Hump Day" on Wednesday, and "Thank Goodness It's Friday!" on, what else, Friday. Or how about "Happy Birthday" on your birthday or—this could be a lifesaver—Call your wife" on your anniversary? For some, an important reminder at the beginning of January, April, June, and September would be "Pay quarterly taxes to avoid penalty." Maybe you have a special Christmas screen saver you've been waiting to use? It would be nice if the screen saver came up automatically on Christmas Day.

You can change the screen saver with the Control Panel Display dialog, but you have to do it manually, and that takes all the fun out of it. With this issue's utility—Screens—you can preschedule a screen saver for a special event, or for a specific day of the week, and have it become the screen-saver-of-the-day automatically when you turn on the computer. If the current day has no special-event or daily screen saver, Screens can activate a default screen saver or choose one at random. Screens also lets you turn the screen saver on or off with a single click of a

Screens

Screens lets you schedule screen savers by the day of the week or special dates such as holidays, birthdays, and anniversaries. You can also use Screens for quickly enabling or disabling the screen saver without changing any of your other settings.



button without having to select or deselect the current screen saver.

Screens is a 32-bit utility that runs under Windows 95 or Windows NT 3.51 or higher. You can obtain Screens by download from PC Magazine Online or by mail. Refer to the sidebar "Getting the Files" for details. The source code for Screens, which was written with Borland's visual programming tool Delphi, is also provided for those interested in seeing how it works.

USING SCREENS

To install Screens, simply run the INSTALL program. It will install the necessary files in a subdirectory on your hard disk, create an icon for Screens in your shell, and also put a shortcut into your StartUp folder so that Screens can activate the screen-saver-of-the-day each time you start the system.

When you first launch Screens, you'll see a dialog with a list of screen savers down the left-hand side (see Figure 1). These are all the screen savers found in your Windows and System directories (the same ones found in the Display Properties list). You can choose a screen saver from this list and preview it or change its configuration settings. The Wait box above the list shows the current screen-saver delay in minutes. Pressing the *Apply Now* button will select the highlighted screen saver as the system screen saver, and it will also apply any changes you've made to the wait time.

You'll note that there is not a (*None*) selection in the screen-saver list as there is in the desktop Display Properties dialog. Instead, at the top-left corner of the dialog are *ON* and *OFF* buttons for enabling and disabling the screen saver. These buttons provide a quick and easy way to turn the screen saver on or off before running, for example, a backup application. You don't have to choose (*None*) and then later relocate your favorite screen saver in the list.

The rest of the dialog is occupied by three tabbed pages that let you define screen savers for special events, days of the week, and days for which no screen savers are defined (the default screen saver). To determine the screen saver for the current day, Screens first checks to see if the day matches any of the special-event dates; if a match is found, it uses that date's screen saver. If not, it checks whether a screen saver is defined for the current day of the week. If so, it uses that one. If there's no daily screen saver, it uses the default screen saver. Let's look at those three tabs in more detail.

SPECIAL-EVENTS SCREEN SAVER

The grid on this page is initially blank, so your first task is to define the dates for which you want special screen savers. Clicking the *Insert*

FOR PROGRAMMERS ONLY Screens is a 32-bit Windows application written with Borland's visual programming tool Delphi. It compiles under Delphi 2.0 or higher. Screens' source code is available on PC Magazine's Web site (www.pcmag.com) and demonstrates several programming techniques, including the following:

- finding the descriptive names of 32-bit and 16-bit screen savers;
- finding the dates of holidays requiring calculations, including Easter;
- getting and changing information about screen savers.

SUPPORT Help for PC Magazine's free utilities can be obtained in our online discussion areas, both on the World Wide Web (www.pcmag.com/discuss.htm) and on ZDNet in the Utilities section of ZDNet's Tips Forum (GO ZNT:TIPS). The authors of current utilities generally visit this forum daily. You may find an answer to your question simply by reading the messages posted in the forum. If the author is not available and the forum sysops can't answer your question, the Utilities column editor, who also checks this forum each day, will contact the author for you.

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Date button brings up the Choose Date dialog (see Figure 2). This dialog lets you choose a date in three different ways, each with its own tab: *Calendar*, *Holidays*, or *Calculated Date*.

First, and simplest, you can choose a date from the calendar. If the *Annual* box is checked, the utility knows that the event will recur every year on the specified date. If the *Annual* box is blank, the utility knows that the event will occur just once, on the exact date (month, day, and year) you've selected.

The second tab lets you quickly select a number of standard holidays. Some, such as Valentine's Day, always occur on a particular date—in this case February 14. Others, such as Thanksgiving, are defined by month and day of week. Thanksgiving is the fourth Thursday in November, which Screens expresses as Nov-Thu #4. Easter is a special case, as it can occur on a wide range of dates in March or April. When you choose a holiday, the appropriate date code will be inserted in the grid. You can also create user-defined events based on month, day of week, and day-index, where day-index is the month's first, second, third, fourth, or last occurrence of the day of week. (The last instance is represented internally as -1.)

For each special event in the grid, you must define a screen saver. Either drag the screen saver from the list at the left, or highlight it and press the *Add SS to Date* button. Windows 95 comes with a screen saver called Scrolling Marquee, which scrolls text horizontally across the screen; if you are using the marquee screen saver (identified by the word *marquee* in its name), you can also enter marquee text for an event. For example, you might define your anniversary as a special event, add the Scrolling Marquee, and define the marquee text as "Don't forget flowers!"

The *Remove Date* button removes the currently highlighted date from your special-events list. You can also select the date and click *Delete*. The *Erase All Dates* button should be used with caution, as it completely empties the list of special events.

DAILY SCREEN SAVER

At the top of the *Daily Screen Saver* tab, you'll find a three-column list. The first column contains the days of the week, the second column holds the screen saver associated with each day, and the third column is labeled *Marquee Text*. To attach a screen saver to a day of the week, simply drag it from the list at the left to the appropriate row. If you prefer, you can highlight the desired screen saver and then press the *Add SS to Day* button.

If the selected screen saver's name contains *marquee*, you can enter in the cell next to the screen saver the text that scrolls across the screen when the screen saver is active. For example, if you want to see "I hate work" on Monday, first place the marquee screen saver in the column next to "Mon" and then edit the text in the Marquee Text column to "I hate work." The Marquee Text column only has meaning when you select a marquee screen saver; it is grayed and inaccessible otherwise.

To change the screen saver for a day of the week, simply drag a new screen saver into place, or highlight the screen-saver cell and click the *Add SS to Day* button. Other buttons clear the screen saver for the highlighted day and clear all daily screen savers.

DEFAULT SCREEN SAVER

If Screens doesn't find a special-event screen saver or daily screen saver, it uses the default screen saver, defined on the *Default* tab. To select a default screen saver, place its name in the one-row grid at the top of the page, then

COMMAND LINE PARAMETERS

Screens accepts three command line arguments: /C for Choose, /D for Disable, and /E for Enable. So far, we've been looking at Screens' main window, which is what you get if you don't specify any command line arguments. Most days, you won't need to see this configuration dialog—you'll just want Screens to activate the day's screen saver. The command line switch /C invokes this behavior. Since you'll normally want Screens to choose the day's screen saver each time Windows starts, the INSTALL program places a shortcut for the command *SCREENS/C* in the StartUp folder. If you want to *prevent* Screens from running at start-up, just move this shortcut to another folder.

Run Screens with the /D parameter to disable the screen saver, just as if you were to click the *OFF* button in the main window. The /E parameter enables the screen-saver activation, as if you were to click the *ON* button. You could take advantage of these parameters in a batch file to run a program with no screen-saver interruption:

```
SCREENS /D
START /W PROGRAM.EXE
SCREENS /E
```

START /W, in the second line, launches the program and waits for it to terminate before letting the batch file continue execution.

PROGRAMMING SCREENS

Manipulating screen savers programmatically is straightforward for the most part, but finding a descriptive name to display in the selection list can be tricky. For 32-bit screen savers, the long filename is the descriptive name, but for 16-bit screen savers the description must be extracted from the executable header. Screens digs deep to give you an understandable list. Defining holidays is another challenge, since many don't occur on specific dates; the contortions required to calculate the date of Easter in particular are amazing. We'll also look at a grab bag of functions for getting and changing information about screen savers.

SCREEN-SAVER NAME

Screen savers normally reside in the Windows directory or the System directory; that's where the Display Properties dialog looks for them. So to make its list of screen savers, Screens examines each file in those directories with the extension .SCR. A screen saver's descriptive name is stored differently, de-

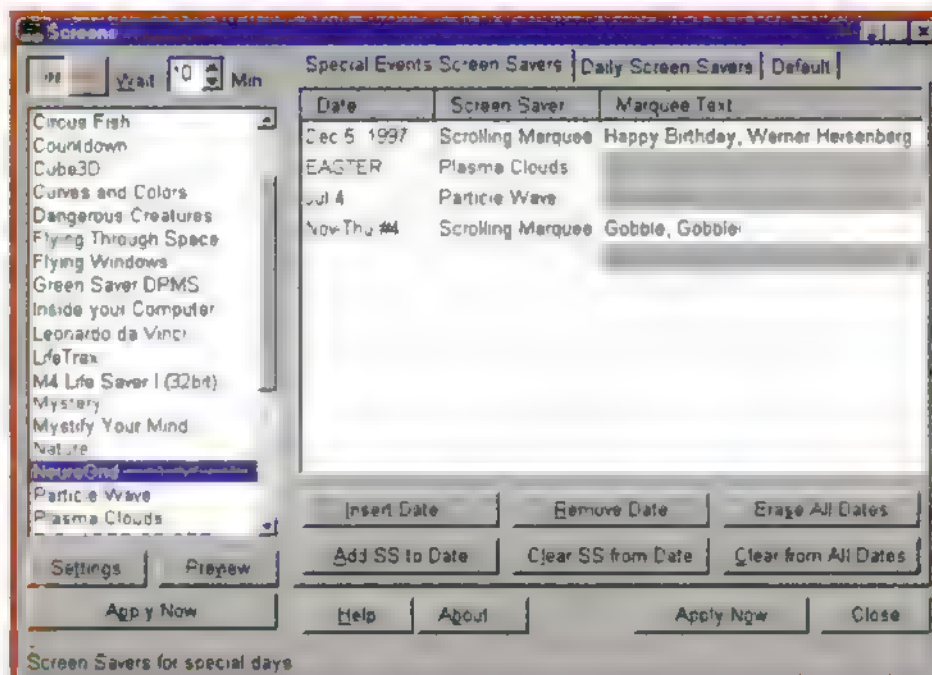


FIGURE 1: Screens' left-hand list box displays the screen savers installed on your system. You associate screen savers with special events or days of the week by using the scheduling pages on the right.

check the radio button titled *Use the default Screen Saver shown here*.

If you prefer, you can use the previously selected screen saver as the default by checking the radio button titled *Do not change the screen saver*. For example, you might want to define a special-event screen saver for the first of each month and use that as the default screen saver on subsequent days in the month. In that case, you'd leave the screen saver unchanged.

Finally, if you like surprises, you can check the box titled *Choose a screen saver at random*. The list from which this choice is made is updated each time you configure Screens. If you add or remove screen savers from your system, simply run Screens, make any changes you wish, and click the *Close* button.

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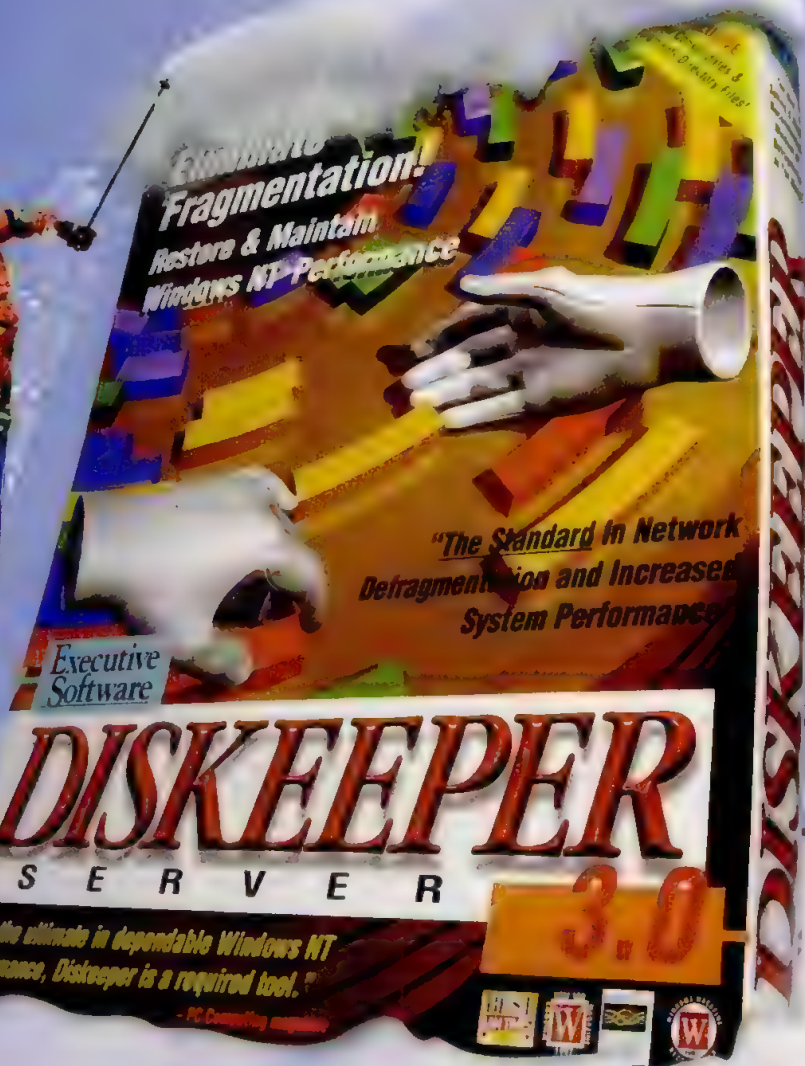
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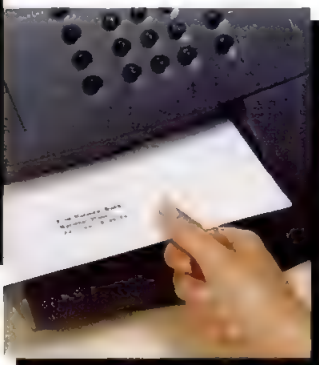
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pending on whether it's a 16-bit screen saver for Windows 3.x, a 32-bit screen saver for Windows 95, or a 32-bit screen saver for Windows NT. So the first step is to figure out what type of screen saver it is.

Every Windows program (including screen savers) starts with an old-style DOS executable header that Screens defines as the data structure `OldExeHdr`. Windows requires much more information to load and run a program than `OldExeHdr` provides, so Microsoft has added the "new executable header" (`NewExeHdr`, in Screens) and placed a pointer to it in `OldExeHdr`. (Note that 32-bit Windows defines yet another format—called the portable executable header—but that as we'll see below, Screens doesn't need to read this one. Screens only needs to know if it's there.) The first 2 bytes of `NewExeHdr` constitute a "signature" that defines whether the header is a new executable ("NE") or a portable executable ("PE").

Screens starts by opening each .SCR file and reading a block of data sized to match the old-style DOS-based executable header (defined as the data structure `OldExeHdr`). After reading the header, Screens does a sanity check to confirm it's actually an `OldExeHdr`, by looking at the EXE signature—the very first 2 bytes of the file. This signature is "4D, 5A" in hex; in ASCII it's "MZ," the initials of Mark Zbikowski (one of the three developers of DOS 2.0). The location of `NewExeHdr` is found at offset 3Ch of `OldExeHdr`. Screens reads the `NewExeHdr` signature to see whether it's an NE or PE header.

The Win32 SDK documentation says that the descriptive name for a 32-bit screen saver (the PE signature) is stored as a string resource with a numeric ID of `IDS_DESCRIPTION`. (The value of `IDS_DESCRIPTION` is 1.) Windows NT honors this convention, but Windows 95 does not, using instead the screen saver's filename. If Screens detects that it is running under Windows NT, it loads the screen saver into memory using `LoadLibraryEx`—with the `LOAD_LIBRARY_AS_DATAFILE` flag—and extracts the `IDS_DESCRIPTION` resource string. If the string is blank, or if Windows 95 is the operating system, Screens uses the filename for the descriptive name.

For a 16-bit screen saver (with an NE signature), Screens reads `NewExeHdr`. The descriptive name is stored as the first entry in the nonresident names table, and this table's location is found in `NewExeHdr`. Screens reads a block of data from the screen-saver file, starting at the nonresident names table's offset. The first byte is the descriptive name's length. The descriptive name for a screen

saver is supposed to be prefaced with `SCRN-SAVE`. In practice, this usage is inconsistent—sometimes the prefix is absent, and sometimes it's followed by a colon, or a colon and a space. Screens strips off the prefix (if found) before storing the descriptive name.

IS TODAY SPECIAL?

When you start Screens with the /C parameter, its first task is to determine whether the current date matches any of the special events you've defined. It reads the list of special-event dates from `SCREENS.INI` and compares each date string with the current date until it either finds a match or reaches the end of the list. The function `MatchesToday` handles this comparison.

There are four kinds of special events: specific dates, annual dates, calculated dates, and Easter. Here are some examples, showing a string representation of each event type. Note that all four of the example

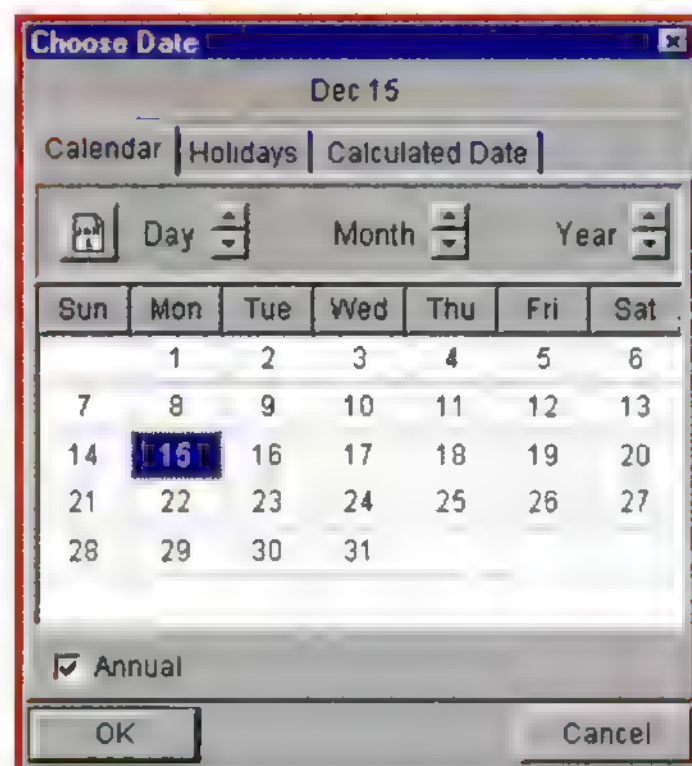


FIGURE 2: Clicking the Insert Date button brings up the Choose Date dialog, which lets you choose a date in three different ways, each with its own tab: Calendar, Holidays, or Calculated Date.

strings match the date April 12, 1998.

"EASTER"	(Easter—a special case)
"Apr-Sun #2"	(calculated date—second Sunday in April)
"Apr 12"	(annual date—April 12 of any year)
"Apr 12, 1998"	(specific date)

First, `MatchesToday` looks to see if the date string is "EASTER." If so, it calls the function `Easter`, described below, to get the date of Easter for the current year. If that date matches the current date, the Easter screen saver is selected.

If it's not Easter, `MatchesToday` checks for a

calculated date by looking for the character "#" in the date string's ninth position. If the date string represents a calculated date, `MatchesToday` converts the current date into a calculated date for comparison.

A calculated date is built from the month name, the day of the week, and the day-index. The first occurrence of a particular day of week in the month has a day-index of 1, the second a day-index of 2, and so on. The last occurrence (which may be either the fourth or fifth occurrence) is represented by a day-index of -1. Note that the fifth occurrence of a particular day in the month is *always* the last, while the fourth occurrence *may* be the last.

To calculate the day-index, we subtract 1 from the day of the month, divide the result by 7, discard any remainder, and add 1. For example, December 25, 1997, is a Thursday; subtracting 1 from 25 yields 24; dividing 24 by 7 without remainder gives 3; and adding 1 to 3 yields 4, meaning this is the fourth Thursday in December. Screens never uses a day-index of 5, so if this calculation yields 5, the `MatchesToday` function automatically changes the index to -1.

As noted above, the fourth occurrence of a given day of the week may also be the last. To determine whether this is the case, `MatchesToday` adds seven days to the current date and checks whether the result is within the same month. If it is not, `MatchesToday` creates a new representation of the current date as a calculated date, using a day-index of -1, and checks the representation once more against the date string.

If the date string is neither "EASTER" nor a calculated date, `MatchesToday` tries to convert the current date into a string with the same format used by Screens for storing specific dates. This format is represented by the string "mmm d, yyyy," where mmm is replaced by the three-letter month abbreviation, d is the day of the month with no leading 0, and yyyy is the four-digit year. If this format precisely matches the passed string, a specific-date match has been found. Otherwise, if the month and day (the portion of this format before the comma) precisely match the passed string, an annual-date match has been found.

The date of Easter varies from year to year, sometimes occurring in March, sometimes in April. To figure out whether a given date is Easter requires some complicated calculations. I searched the Internet for algorithms and found one that does the job. Easter is defined as the first Sunday after the paschal full moon. The paschal full moon is not an actual astronomical event; rather, it is a day identified by an artificial value, which is determined from tables and calculations. It may differ from the date of the true full moon by as much

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EMPLOYEE'S SOCIAL SECURITY: 123-45-6789

EMPLOYEE'S DATE OF BIRTH: 01/01/1950

EMPLOYEE'S DATE OF FULL-TIME EMPLOYMENT: 01/01/1980

EMPLOYEE'S CURRENT POSITION: Manager

EMPLOYEE'S SUPERVISOR: John Doe

EMPLOYEE'S PRIMARY CARE PHYSICIAN: Dr. John Doe

EMPLOYEE'S DATE OF LAST PHYSICIAN VISIT: 01/01/2000

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as two days. This calculation-based definition is necessary, because the actual full moon can occur on different calendar days in different parts of the world. The Easter function (which is available for downloading from PC Magazine Online) performs the necessary calculations to determine the paschal full moon, and it returns the date corresponding to the following Sunday.

SCREEN-SAVER MISCELLANY

Controlling screen savers programmatically requires the use of quite a few specialized API functions, and there are some surprises along the way. We'll hit a few of the high points so you don't have to learn the hard way.

A screen saver has two executable sections in it: a configuration dialog and the actual screen saver. When the screen saver is invoked with /C or -C on the command line or with nothing on the command line, the configuration dialog is invoked. When the command line switch /S or -S is used, the screen saver itself is launched. In Screens, pressing *Preview* launches the highlighted screen saver with the /S switch, and pressing *Settings* launches it with the /C switch.

The ShellExecute function can't be used to launch the screen saver, because this function always invokes preview mode, regardless of the command line switch. ShellExecute seems to include some special-case code for screen savers. The solution that I found is simple—Screens calls the screen saver using the antique WinExec function, carried over from Windows 3.x. Another solution would have been to launch the screen saver using the Win32 function CreateProcess, but this seemed unduly complicated.

There are other oddities as well. For example, you'd think Windows 95 would refer to the current screen saver using long filenames. You'd be wrong! The current screen saver is defined by the SCRNSAVE.EXE= entry in the

[Boot] section of SYSTEM.INI, and it must be stored using a short filename. Screens uses the handy API function GetShortPathName to convert the selected screen-saver name before storing the file in SYSTEM.INI.

Any time your programs need to get or set system information, chances are good you'll wind up using the Windows API function SystemParametersInfo. Screens uses this function to enable and disable the screen saver, check whether the screen saver is enabled, and get or set the screen-saver time-out delay. SystemParametersInfo takes four parameters:

uiAction	defines the desired action
uiParam	varies depending on the action
pvParam	varies depending on the action
fWinIni	defines how a SET action will be communicated to the system

That last parameter deserves further explanation. When SystemParametersInfo changes one of the system parameters, the change takes place immediately. However, programs that are already running may still be using the old value. Also, if the parameter in question is initialized through WIN.INI, it will be restored to its old value the next time Windows restarts. Two flag values for the fWinIni parameter prevent these two problems. The SPIF_UPDATEINIFILE flag causes SystemParametersInfo to record the parameter change in WIN.INI, if indeed the parameter value is stored there. And the SPIF_SENDWININICHANGE flag causes SystemParametersInfo to broadcast a WM_WININICHANGE message to all top-level windows, giving them the opportunity to obtain and use the new parameter value. Any time Screens calls this function to set new values for system parameters, the utili-

ty includes both of these flags.

In most cases, a SystemParametersInfo call that sets a new value will pass the value in the uiParam parameter and leave the pvParam parameter set to NIL. A SystemParametersInfo call that gets an existing value will usually leave uiParam set to 0 and set the pvParam parameter to the address of a variable that will receive the value. For example, to disable the screen saver, Screens makes this call:

```
SystemParametersInfo(SPI_SETSCREEN-  
SAVEACTIVE, 0, nil, SPIF_UPDATEINI-  
FILE OR SPIF_SENDWININICHANGE);
```

To reenable screen-saver activity, it uses this call:

```
SystemParametersInfo(SPI_SETSCREEN-  
SAVEACTIVE, 1, nil, SPIF_UPDATE-  
INIFILE OR SPIF_SENDWININICHANGE);
```

If you're not already familiar with SystemParametersInfo, look it up in the Windows help. You'll be amazed by the number of different parameters it can query and change!

IN CLOSING

Screen savers can be fun. They can be even more fun if a relevant screen saver runs automatically according to a prearranged schedule. Try scheduling a screen-saver message for a far-off event. Screens will pleasantly remind you when the event arrives, long after you've forgotten about the date. Or simply have Screens randomly choose a screen saver for you each day. I hope Screens brings you some fun. **PC**

Neil Rubenking is a contributing editor of PC Magazine. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

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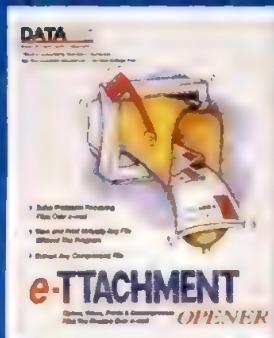
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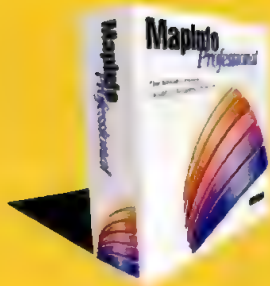
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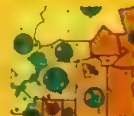


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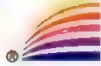
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User-to-User

BY NEIL J. RUBENKING

Make Your DLLs Show Their True Colors

Here's a suggestion for enlivening your DLLs and Control Panel applets. Launch your favorite text editor, create a new file, and type the following, taking special care to avoid any typos:

```
REGEDIT4
[HKEY_CLASSES_ROOT\cp1file\
DefaultIcon]
@="*1"
[HKEY_CLASSES_ROOT\d11file\
DefaultIcon]
@="*1"
```

Save the file as *Dll.reg* on your desktop, or in some other conspicuous place. Close the editor, then find this file and right-click on it. Select *Merge* from the pop-up menu. If you didn't make any typing mistakes, you will be notified that the information in your file has been successfully entered into the Registry.

Now, take a look at your *C:\Windows\System* directory and behold: Instead of that generic old icon with the two gears, any DLLs and Control Panel applets (CPLs) that contain even one icon will show something more interesting—the first icon they contain. In nearly all cases, this makes them much more noticeable in large folders and also gives an indication of their function. The only possible drawback (although I don't consider it to be one) is that DLLs and CPLs that do not contain icons are represented by the "unknown type" icon.

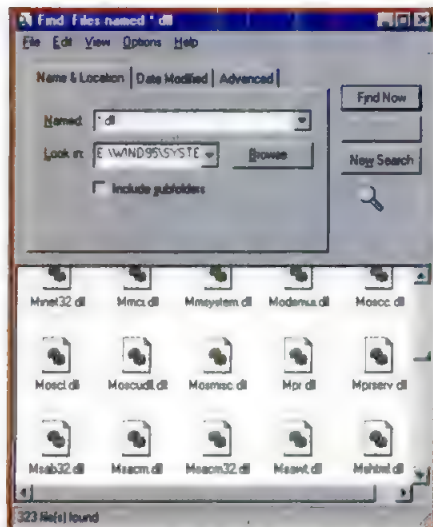


FIGURE 1: By default, all DLLs display the same icon.

icon (that is, the generic document icon with the Windows logo). This doesn't bother me a bit, and I find the trade-off to be well worth it!

JASON FISHER
Dallas, Texas

PC MAGAZINE: By default, Windows .EXE files are represented in Explorer by the first icon they contain, and .DLL files all use the same icon. That's because while virtually every

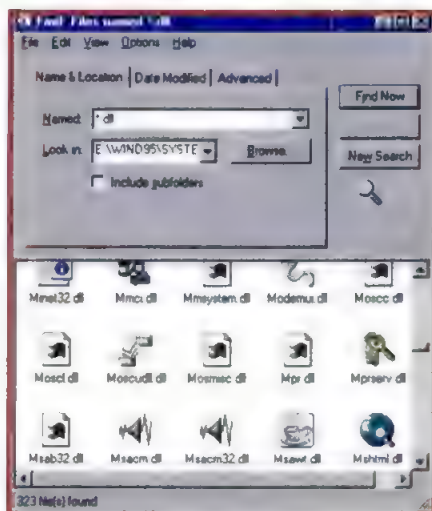


FIGURE 2: After the modification, each DLL shows the first icon contained within it. DLLs that contain no icons are represented by the "unknown type" icon.

Windows executable contains at least one icon, many DLLs do not. The other important distinction is that you can launch executables by double-clicking them, while you can't launch .DLLs. Control Panel applet files (.CPL files) are a mixed bag: You can launch them, but some .CPL files (such as *Main.cpl*) contain multiple applets, and only one can be launched by double-clicking the file in Explorer. Still, as this reader notes, the icon contained in a DLL may well give a clue as to its purpose. Figures 1 and 2 show a handful of DLLs before and after this treatment.

Note, too, that you can make this same adjustment for bitmap files. If you do, each bitmap will display in Explorer as a tiny thumbnail of itself. This can be handy when sorting through lots of bitmaps, though it can also slow down the process of displaying a new directory in Explorer. To enable built-in thumbnails, simply add another pair of lines to the .REG file, replacing "dl1file" or "cplfile" with "Paint.Picture."

If you have installed another bitmap editor,

this technique may not work, because the internal type name for .BMP files will be something other than "Paint.Picture" (for example, "PSP.Image"). To find out just what name to use, launch Regedit, press Ctrl-F (for Find), and enter ".bmp" as the string to find. Check the *Match whole string only* box and the *Keys* box, but leave the other two unchecked. You should find a key named ".bmp," and the name of the file type will appear in Regedit's right-hand pane.

Shift-Click and the Windows 95 Desktop

In the November 18, 1997, item titled, "Get More from Explorer," you suggest double-clicking on My Computer with the Shift key pressed. When I do this, many of the icons, shortcuts, and files that are on my desktop become selected, and Explorer tries to open panes to all these selected icons, shortcuts, and files! Similar results occur when I double-click on other desktop items. Sometimes half the desktop items are selected, and sometimes fewer. This reduces the usefulness of double-clicking with Shift.

HUBERT FITCH
via the Internet

PC MAGAZINE: What's happening here can be a useful feature of the Windows 95 desktop, once you understand it. When you click on a desktop icon, then Shift-click on another icon, you are selecting multiple icons. Picture a rectangle whose diagonally opposite corners are defined by the two icons. The two corner icons plus all other icons that lie entirely or mostly within this rectangle will be selected. You can use this feature to select a group of icons on the desktop and, for example, move them en masse to a new location.

Now it's clear what caused the problem described above. This reader used Shift-double-click with the My Computer icon while another icon was highlighted. The initial Shift-click selected a whole group of icons, and then the Shift-double-click made the system try to "Explore" all of them. To avoid running into this problem, always single-click the My Computer icon to highlight it before you Shift-double-click the icon.

IE 4 users, beware! It's quite possible that neither technique mentioned here will work for you, because IE 4 optionally modifies the system to invoke icons browser-style, with a single click.

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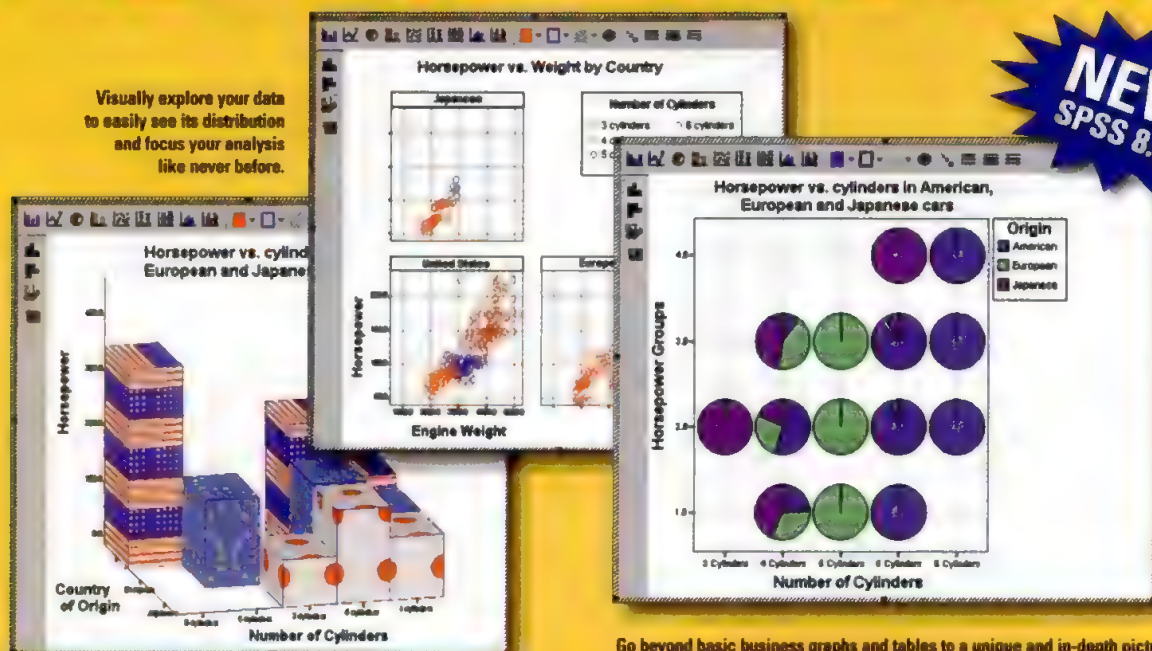
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HARDWARE

When Two Are Better than One

I have a Pentium system with a single hard disk that is getting full. Would I be better-off buying a second hard disk, or should I just replace the existing disk with a higher-capacity one?

SCOTTY SCOTT
via the Internet

PC MAGAZINE: There are at least two good reasons to add a second disk rather than replacing your current disk with a new one.

Perhaps the best reason is improved performance. Assuming you're running Windows 95 or some other operating system that relies on hard disk space for virtual memory, you can gain speed by putting the swap file and other temporary files on a disk other than your main one. That's because the read/write heads won't have to shuttle back and forth between program or data files and your temporary files, which saves time and speeds disk operations.

Another good reason to add a second disk is that such a configuration provides a small level of redundancy, so if one disk should suddenly stop working, you'll still have another that you can use to get your system back up and running. With a single-disk configuration, you'd have to purchase a new disk before you could do anything.—Alfred Poor

The Sounds of Silence

I have a new system with a speakerphone modem, but I have a problem configuring it. If I plug my speakers into my sound board, I get sounds from programs, but I can't hear the person when I place a call with the Win 95 phone dialer. If I plug the speakers into the jack on the modem, I can hear the other side of the conversation without a problem, but then I don't get sound from other programs. Can't I have sound from my modem and sound card at the same time? Please help!

JIM ALAIMO
via the Internet

PC MAGAZINE: If this is a new system, then you should be able to get the vendor to help you configure it correctly. In any case, your problem should be fixed with just one simple cable.

You want to get a standard stereo patch cord with mini-jack (3.5-mm) plugs on each end. Plug one end into the speaker-output jack of your modem and the other in the line-input jack on your sound card. Open the

mixer utility for your sound card (double-click on the volume control in the taskbar) and make sure that you do not have the line-in channel muted and that the levels are set appropriately. Then connect the speakers to your sound card.

With this configuration, the output from the modem will be passed through the sound card and to the speakers, so you'll be able to hear the people you call on your computer and still hear the sounds from your programs.—Alfred Poor

OPERATING ENVIRONMENTS

Changing the Default Action For Batch Files

I have never needed to run batch files from Windows, but I do like having the ability to view them by associating them with either EDIT.COM or Notepad and double-clicking on them. In Windows 3.1 this was a simple task: You just edited the Win.ini Programs= line to delete "bat."

But in Windows 95 I can't find an easy way to do this. I suspect there is a similar line in the Registry somewhere, but after much browsing I have had no success. Can you help?

WILM MEYER
via the Internet

PC MAGAZINE: What you want to do is change the default action for .BAT files. Normally you'd just use the File Types dialog in Explorer, but the system won't let you change the default action for executable files, including batch files. Here's how to get around that limitation. Run Regedit, open the HKEY_CLASSES_ROOT key, and scroll down to the subkey named batfile. In the right-hand pane you will see a value named EditFlags. Make a note of the data for this value (it will probably be D0 04 00 00), then edit it to be all 0s (00 00 00 00).

Select Options from Explorer's View menu, flip to the File Types page, and select MS-DOS Batch File. Press the Edit button. You'll see a list of actions, with "open" boldfaced. Select Edit in that list and press the Set Default button. Now press OK twice to shut down those two dialog boxes. Finally, go back to Regedit and restore the original data of that EditFlags value. From now on, when you double-click a .BAT file it will be opened in Notepad. You can still right-click it and select Open to run it.—Neil J. Rubenking

Editing Context Menus

I would like to find a way to edit my context menus. Since I installed Windows 95 on my system, many programs have added items to various context menus during installation. Some of these programs have since been removed, but their additions to the context menus remain. (A few programs have even added two copies of the same command to the same menu!) How can I remove the entries I no longer want? Also, do you know if it is possible to customize context menus? That is, can I rearrange the order of the items in a menu, introduce or delete a separator, rename the entries, and so on?

NORMAN B. GROVER
Jerusalem, Israel

I know how to associate a new right-click menu action to a file type in Windows 95 Explorer. What I'd like to be able to do is add an action to the right-click menu for all files. I know it's possible, because WinZIP, Norton Navigator, and other applications do this. Can you tell me how?

PAUL FILSTEIN
via the Internet

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PCTech Ask Our Advisors

PC MAGAZINE: You edit file type-specific context menus through Explorer. Select *Options* from the View menu, click the *File Types* tab, and select the file type from the list. Click *Edit*. Now you can edit, add, or remove context menu options. Note that for a few special file types, such as executable files (programs) and batch files, Explorer limits your ability to change the context menu options.

To add a menu choice for all files, start by associating it to a single file type. Chose *Options* from the View menu, click on the *File Types* page, select any file type, and press the *Edit* button. In the Edit File Type dialog, press the *New...* button and give your new action a distinctive name, say, ZZZNORK. Press the *Browse...* button and locate the application that should perform the action. When you have the command line entered correctly, press *OK*, press *Close*, and then press *Close* again. At this point you may want to right-click on a file of the chosen type and make sure the menu choice is working correctly.

Now run Regedit and search for ZZZNORK: Press Ctrl-F, enter ZZZNORK, check only the *Keys* check box, and press *Find Next*. You should find it under a key with a name formed like HKEY_CLASSES_ROOT\FileName\shell. Select *Export* from the Registry menu and export this branch to TEMP\\$.REG. Delete the ZZZNORK key and close Regedit.

Open TEMP\\$.REG in your favorite editor and change every occurrence of the file type name to * (a single asterisk). Change every occurrence of ZZZNORK to the name you want displayed for your new menu item. Save the file, then launch it. You've just added a menu item for all files. To add a menu item specifically for files whose types are not registered with the system, do exactly the same thing, but use the word *Unknown* in place of the asterisk.

If this process seems a bit tedious, you may prefer to download the *PC Magazine* utility MENUEDIT. This utility will edit the right-click context menu choices for individual file types or for all file types.—Neil J. Rubenking

WORD PROCESSING

Easier Customization in Microsoft Word 97

I recently tripped across a feature in Microsoft Word 97 that doesn't seem documented but can be extremely useful for anyone who customizes keyboard shortcuts. Word will let you attach a one- or two-keystroke keyboard shortcut to any command. It will also let you

change, delete, or add to the shortcut for each command. The hard part is figuring out the name of the command to attach a shortcut to. There are various ways to find the name, but most are clumsy. As it turns out, there's also one easy way to find the name for any command attached to a toolbar button or pull-down menu.

Suppose, for example, that you want to use a keyboard shortcut for the Format Painter. As shipped, Word 97 offers the shortcut Ctrl-Shift-C. But you may not find this easy to remember and may prefer, say, Ctrl-F-P—as a mnemonic for Format Painter.

The solution: Ignore Word's instructions telling you to choose Tools | Customize, then choose Keyboard, and then try to find the right command. Instead, hit Ctrl-Alt-Keypad Plus> (that's the Plus sign on the numeric keypad). The mouse cursor will change to a clover design. Click on the Format Painter button and Word will open the Customize Keyboard dialog box with the right command (Copy-Format) already selected. Now you only need to type a key combination in the Press New Shortcut Key box, choose Assign, then choose Close, and you're done.

JAMIE MCCOLOUR
Rosemont, Pennsylvania

PC MAGAZINE: This feature has actually been available in Word since at least Version 6, but it's so well hidden that I'll bet few people know about it. It works with Word's context-sensitive right mouse button menus and with shortcut keys, as well as with toolbar buttons and pull-down menus (which in Word 97 are treated as toolbars also). After hitting Ctrl-Alt-Keypad Plus>, you'll get the same effect by hitting Ctrl-Shift-C as by clicking on the *Format Painter* toolbar button (assuming, of course, that Ctrl-Shift-C is still attached to the *CopyFormat* command).

The Word command associated with this shortcut is *ToolsCustomizeKeyboardShortcut*, and you can add a shortcut for this command as well. This command will be particularly useful for laptop users, who may have no separate numeric keypad. (In that case you'll have to scroll through the list of commands to find this one.) If you do have a numeric keypad, the easiest way to associate a keyboard shortcut with *ToolsCustomizeKeyboardShortcut* is to hit Ctrl-Alt-Keypad Plus>, then hit Ctrl-Alt-Keypad Plus> again to bring up the dialog box with the command already selected.

If you hit Ctrl-Alt=, the cursor will change to a Plus sign, which is a shortcut feature for adding commands to the menus. This shortcut is not particularly useful, and it is better

ignored. (If you choose a toolbar button or shortcut key that's tied to a command Word recognizes as belonging to a particular menu, Word will add the command to that menu. If you choose a macro, it will add the macro to the Tools menu. You have no control over which menu a command is added to, or where on the menu a command is placed.) The companion shortcut, Ctrl-Alt-Keypad Minus>, is dangerous and is best redefined. Hit this combination and the cursor will change to a large Minus sign. If you then choose a menu item, that item will be removed from the menu.

—M. David Stone

SPREADSHEETS

Emulating 1-2-3 in Excel

I have a Lotus 1-2-3 4.0 spreadsheet that I opened in Excel for Windows 95 and then saved as an Excel workbook. For some reason, now that I've saved the original 1-2-3 spreadsheet as an Excel workbook, when I enter a date (such as 11/15/97) Excel assumes I'm entering a formula. It puts an Equal sign in front of my date and then calculates the result using two division operations. This only happens in my imported 1-2-3 worksheet, not in other Excel workbooks. Do you have any idea why this is happening? I can't figure out what is going on.

DON KIRK
via the Internet

PC MAGAZINE: What's going on is that Excel is doing a clumsy job of trying to help you out. You can make it behave "normally" by going to the *Options* command (on the Tools menu), clicking the *Transition* tab, and clearing the check box that says *Transition Formula Entry*. With this setting checked (on), Excel tries to mimic 1-2-3's formula-entry behavior. For example, if you enter *1 Park Avenue* with *Transition Formula Entry* on, Excel gives you an error message—because that's what 1-2-3 would do (1-2-3 would try to interpret the entry as a formula, because it starts with a number). If you enter *11/15/97*, Excel divides 11 by 15, then divides the result by 97, just as 1-2-3 would. Turning *Transition Formula Entry* off won't change any data you've already entered, but it will make Excel handle future entries in the program's normal fashion, not the 1-2-3-mimicking fashion.

The *Transition Formula Entry* setting also affects the way Excel handles named ranges. With this setting on, range names are automatically applied to formulas. If cell A1 is named *Home*, the formula =A1 gets recorded as =Home. If you subsequently delete *Home*

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from Excel's list of range names, the formula that refers to A1 simply becomes =A1. This is the way things work in 1-2-3, so it's also the way things work in Excel with Transition Formula Entry on.

With Transition Formula Entry off, names are not automatically applied to formulas. In this mode, the formula =A1 would still be recorded as =A1, even if A1 were named Home. If you do apply the name to the formula (either by explicitly typing =Home in the first place or by using the *Insert Name Apply* command) and subsequently delete the name, the formula returns a #NAME? error.

Some macros written in 1-2-3's original keystroke macro language depend on 1-2-3's named-range behavior. If a worksheet containing one or more of these macros is imported into Excel and run with Transition Formula Entry off, the macros may fail. For this reason, and because early 1-2-3 macros were always stored in ranges whose names started with the Backslash character, Excel always turns Transition Formula Entry on when you import a 1-2-3 worksheet that contains at least one range name beginning with \, regardless of what version of 1-2-3 the worksheet comes from. Imported 1-2-3 worksheets that don't have range names starting with \ do not have the feature turned on by default.

Unless you're running keystroke macros in imported 1-2-3 worksheets, having the Transition Formula Entry setting in the wrong position is probably no more than a minor nuisance. Another of Excel's "transition" features, however, can actually affect the values of formulas. The feature is called Transition Formula Evaluation, and unlike Transition Formula Entry, it is turned on by default for all imported 1-2-3 files, regardless of their contents.

As its name suggests, Transition Formula Evaluation causes Excel to evaluate formulas the same way 1-2-3 evaluates them. For the most part, the two spreadsheet programs evaluate formulas in a similar manner—but there are a few differences. One of these differences has to do with the way Excel and 1-2-3 handle references by arithmetic formulas to cells containing text. Suppose, for example, that cell A1 contains the word *Text* and cell A2 contains the number 100. A 1-2-3 formula that multiplies A1 by A2 returns 0, because the text cell is regarded as a 0. The same formula in Excel returns an error constant (#VALUE!), because Excel regards the text cell as a nonnumeric data type that cannot be used in an arithmetic formula. (Excel will try to convert text to a number when you reference the text that way, but if it cannot, it

returns #VALUE!) Turning Transition Formula Evaluation on makes Excel behave exactly like 1-2-3.

Excel and 1-2-3 also have different ways of handling lookup functions, the INT and MOD functions, logical formulas, and computed criteria in database criteria ranges. Because of all these differences, if you regularly work in both spreadsheet programs, or if you're an Excel user sharing files with 1-2-3 users (or vice versa), you'd do well to leave Transition Formula Evaluation on. On the other hand, if you're migrating 1-2-3 worksheets to Excel exclusively for your own use (and you don't also continue to work in 1-2-3), consider converting your worksheets to Excel's way of calculating—simply because as you create new worksheets in Excel over time, you will come to expect Excel's behavior, not 1-2-3's.

Having Transition Formula Evaluation turned on presents yet another hazard if you migrate worksheets from Excel 5 to Excel 97. That's because for some reason, Microsoft changed the behavior of this feature in Excel 97. Again assuming A1 contains the word *Text* and A2 contains the number 100, and assuming Transition Formula Evaluation is on in both Excel 5 and Excel 97, note the following interesting differences between the two versions:

Formula	Excel 5	Excel 97
=COUNT(A1:A2)	2	1
=AVERAGE(A1:A2)	50	100
=MIN(A1:A2)	0	100

A final hazard: Both the Transition Formula Evaluation and the Transition Formula Entry settings apply only to the current sheet. Changing the setting on Sheet 1 has no effect on any other sheet in the workbook. User beware!—Craig Stinson

DATABASES

Object Deletions Don't Reduce Database Size

I'm using Microsoft Access 2.0. I've built a database, and the file size has reached over 1.44MB, which is more than a single 3.5-inch disk will hold. I've noticed that every time I delete something from my database, the file size of the database is not reduced. In my word processor, however, the file size will automatically update when you change or delete something. Why isn't the file size reduced when you delete something in a Microsoft Access database?

THOMAS C. BAILEY
Washington, Georgia

PC MAGAZINE: This is a common question. When you delete something in a Microsoft Access database, the space occupied by that object is marked as available but is not removed from the database. The operating system doesn't reflect any change in the file size because the file size hasn't changed—the free space is still inside the database. Microsoft Access is supposed to reuse that space by allocating it to any new database objects you create.

Most word processors automatically return any unused space to the operating system as soon as you save the file. That's why you see an immediate change in the file size. If you want to reclaim the disk space used by objects deleted from an Access database, you have to compact the database.

Compacting makes a new copy of the database with the contents rearranged on-disk. Any space made available by deletions is returned to the operating system, so the database that emerges from compacting is usually smaller. It's a good idea to compact periodically even if you're not concerned about restoring space, because compacting the database can improve performance. For example, searches often perform better, because Access rearranges your possibly fragmented data into contiguous pages.

To compact your database, select the File menu and choose *Compact Database* (in Access 97 select the Tools menu, choose *Database Utilities*, and choose *Compact Database*). Note that Access needs enough available disk space to store two copies of your database temporarily; otherwise the compact operation will fail.—Sal Ricciardi

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#24679	460CDX	166MHz w/MMX*	32MB	2.1GB	10XCD	12.1" FSTN	6.9	'1,949	'78
#97051	440CDT	133MHz w/MMX*	16MB	1.4GB	10XCD	12.1" TFT	6.9	'1,949	'78
#97052	460CDT	166MHz w/MMX*	32MB	2.0GB	10XCD	12.1" TFT	6.9	'2,849	'114
#24680	480CDT	233MHz w/MMX*	32MB	4GB	10XCD	12.1" TFT	6.9	'3,849	'154

*Pentium® processor with MMX® technology versions

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#15086	750CDT	233MHz w/MMX*	32MB	4.7GB	20XCD	13.3" TFT	8.4	'4,099	'160

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#96041	560E	166MHz MMX	16MB	2.1GB	12.1" CSTN	4.1	'2,849	'114
#11247	560X	233MHz MMX	32MB	4GB	12.1" TFT	4.1	'3,419	'137

ThinkPad 380 Series

Order#	Model	Pentium® Processor	RAM	HD	CD	Display	Wt (lb.)	Price	Lease /Month
#94280	380D	150MHz w/MMX*	16MB	1.3GB	8X	12.1" DS	6.7	'1,519	'81
#99913	380ED	166MHz w/MMX*	16MB	2.1GB	20XCD	12.1" FRSTN	7.0	'1,699	'88
#94278	380D	150MHz w/MMX*	16MB	2.1GB	8X	12.1" TFT	6.9	'1,949	'78
#99915	380ED	166MHz w/MMX*	16MB	3.0GB	20XCD	12.1" TFT	7.1	'2,639	'106

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#99908	233MHz w/MMX	32MB	4.6GB	13.3" TFT	'4,179	'167
#99906	233MHz w/MMX	32MB	4.6GB	13.3" TFT	'5,249	'210
#99910	233MHz w/MMX	32MB	5.1GB	14.1" TFT	'4,949	'190

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AST

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#15484	M5200T	200MHz MMX*	32/2.1GB/20X	12.1" TFT	7.2	'3,399
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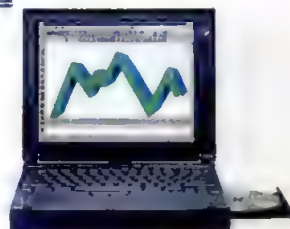
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ThinkPad Notebooks

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735DX, P133MMX, 16MB, 1.6GB	FPC070062	1699.95
765TX, P166MMX, 32MB, 3.2GB	FPC070042	2999.95

Price Break
2499⁹⁵
-500⁰⁰
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-900⁰⁰
3899⁹⁵
FR-PF4WJ-AA



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5200X MT, P200MMX, 32MB RAM, 3.2GB	278800-002	999.95
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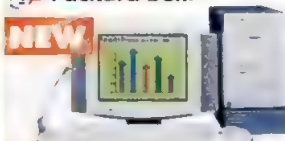
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HP Brio Models

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8174, P200MMX, 32MB RAM, 2.1GB	D5557A#ABA	1299.95
8177, P233MMX, 32MB RAM, 4.0GB	D5415A#ABA	1499.95
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S618, P233MMX, 48MB, 6.4GB	845297	1099.95
	845300	1199.95



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899⁹⁵
845298
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Pavilion Models

8260, P11266MMX, 32MB, 4.0GB	Part#	Price
8275, P11300MMX, 48MB, 8.0GB	D5299A#ABA	1699.95
8280, P11333MMX, 64MB, 8.0GB	D5302A#ABA	1999.95
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4660, P11300MMX, 64MB, 8.0GB	311300-003	1799.95
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Price Before Rebate
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-100⁰⁰
399⁹⁵
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- .25 Aperture Grille Pitch

Additional Monitors	Part#	Price
21" Monitor (19.56" VIS)	MT9021E	1179.95*

*Viewable Image Size *Price before \$50 price break

Price Before Rebate
689⁹⁵
Price Break
-40⁰⁰
649⁹⁵
MT9017E

KDS



- 18.8" Viewable Image Size • 1600x1200ni Maximum Resolution
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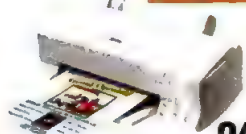
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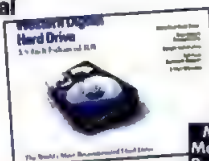
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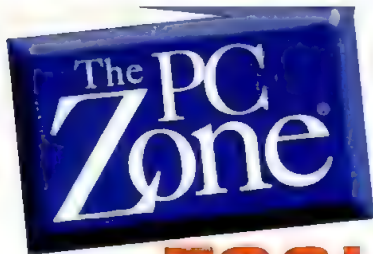
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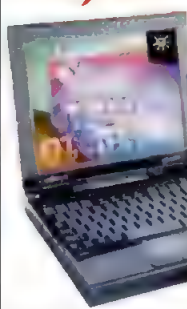
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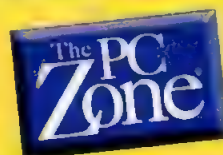
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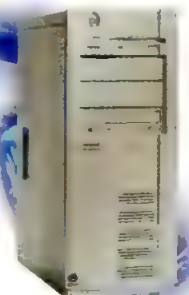
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5200X/3200	200MHz Pentium MMX	32MB	3.2GB	—	\$1135.49	92841
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5233X/3200	233MHz Pentium MMX	32MB	3.2GB	—	\$1298.97	101309
5233X/3200/CDS	233MHz Pentium MMX	32MB	3.2GB	16X Max	\$1479.89	92843
6233X/2100	233MHz Pentium II	32MB	2.1GB	—	\$1495.57	95916
6233X/3200/CDS	233MHz Pentium II	32MB	3.2GB	24X Max	\$1698.41	95917
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64MB	\$238.19	104309	128MB	\$559.89	102592
Latitude CP					
16MB	\$74.07	90165	32MB	\$127.72	90166
64MB	\$278.09	98868			
Dimension XPS D233, 266, 300, Optiplex GXa					
SDRAM					
16MB	\$74.07	90165	32MB	\$127.72	90166
ECC SDRAM					
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64MB	\$385.38	99987			

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Pavilion 3100 w/MMX					
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Keyok XA, XU					
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64MB	\$346.29	98842	128MB	\$619.73	98843
ECC SDRAM					
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64MB	\$385.38	99987	128MB	\$929.83	99177
LaserJet 4000, T, M, TN					
EDO					
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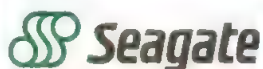
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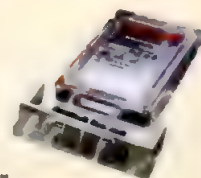
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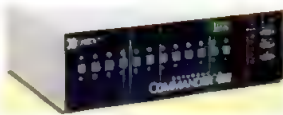
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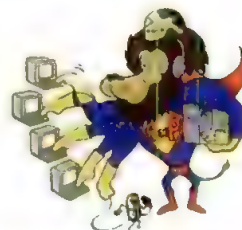
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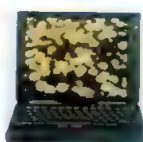
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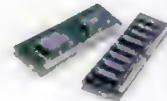
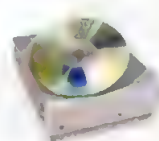
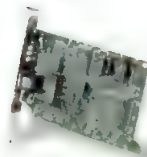
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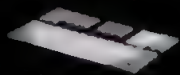
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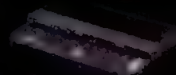
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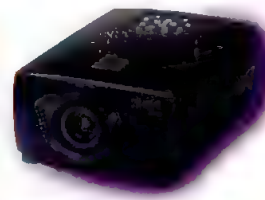
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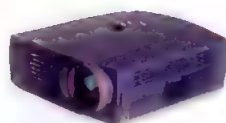
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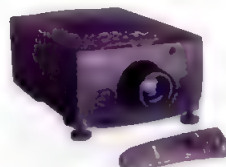


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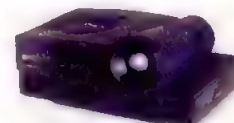
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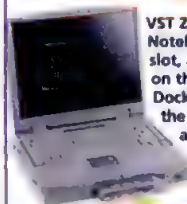
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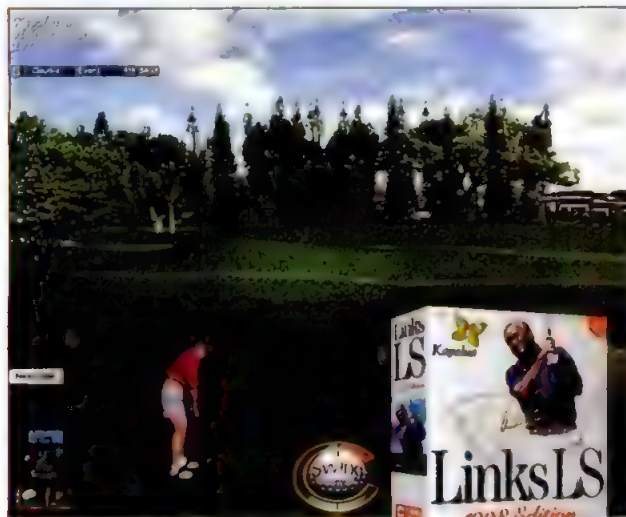
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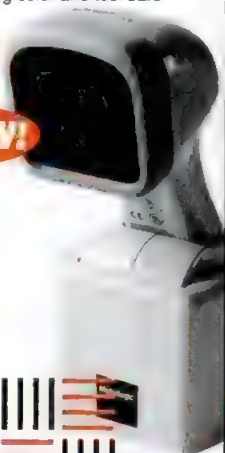
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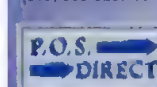


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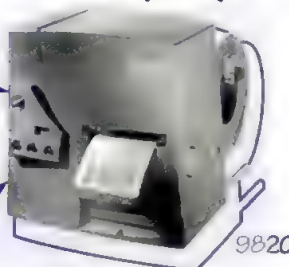


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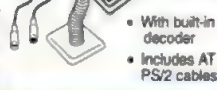
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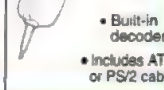
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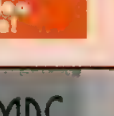
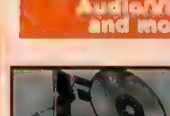
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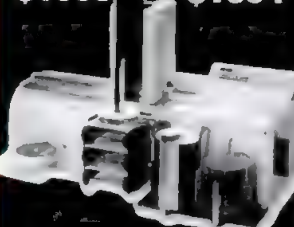
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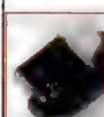
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Source: PC Magazine Marketplace survey, 1997

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After Hours

Get in the Game

Go online with these five services and play against opponents worldwide.

By Michael E. Ryan

Many PC game vendors, in a fairly recent yet far-reaching trend, are offering online multiplayer options. Supporting this growth, online gaming services are becoming more affordable. Instead of paying exorbitant monthly and hourly fees, you can now play most popular games over the Internet for free. By providing ready-made communities of players—complete with chat rooms, message boards, and tournaments—online gaming services offer the best venues for multiplayer action.

We tested five major online gaming services and were impressed with each one, although we feel that each could stand to improve in certain areas. In this roundup, Kali and Total Entertainment Network dazzled us the most.

Heat.net

If you're looking for a gaming service with attitude, action games, and support for lots of players, look to Heat.net. Although it can be a bit slow and clunky, Heat.net offers a few niceties that the other services don't, such as 32-player games of Jedi Knight.

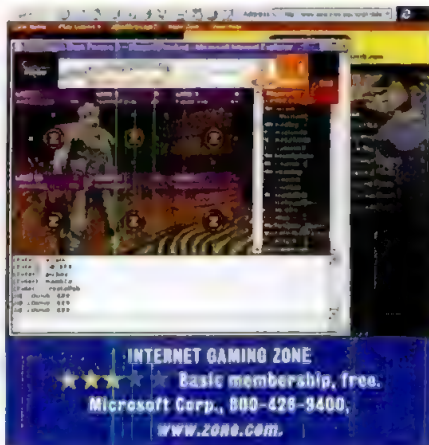
Heat.net offers two levels of service. The basic level, Perimeter, is free and allows unlimited play on most games; it also offers chat, e-mail, player-to-player paging, and Web page

space. Premium service costs \$5.95 a month, but you can pay \$15.99 for three months, \$29.99 for six months, or \$49.99 for a year. Premium service features access to tournaments, more games, and a "frequent player" system for earning discounts.

Heat.net runs on Windows 95 and requires a Java-enabled Web browser. We found the Web-based interface somewhat awkward, and over a 28.8-Kbps connection it's rather slow.

Once you select a game to play through Heat.net, you leave the Web and enter a chat room, with a much better interface. Game play via Heat.net is decent, although it suffers from enough latency to be annoyingly slow. The service's biggest assets are its wide array of action games and its ability to support numerous players.

If SegaSoft adds some variety to the game lineup and does away with the need for a browser, Heat.net could become the king of online gaming.



Internet Gaming Zone

Microsoft's Internet Gaming Zone is a popular spot for classic card and board games, but it also offers a few action and strategy titles. Notably, the Zone is one of the best sites for playing LucasArts' games online. Still, the service's interface is weak and is available only through Microsoft Internet Explorer.

The Zone uses Windows 95 and offers free access to most of its games. As long as you own a copy of the game software (for such games as Jedi Knight and Microsoft Flight Simulator 98), you can play. There are only two fee-based features: Fighter Ace, a World War II flight simulator, costs \$1.95 per day or \$19.95 a month, and for low-latency access to games, you can also use the Dwango-Zone, which will dial you into a dedicated server for your game at a charge of \$0.99 an hour.

Game play over the

Zone is usually quite good, although games often slow to a halt when someone enters or leaves a session. This latency makes things pretty choppy when a game begins. The interface needs improvement—fewer open windows, for example. Also, the chat text scrolls by so quickly that dialogs are often hard to follow. The service does not track player rankings or host tournaments.

The Zone's strongest feature is the size of its user base.

INSIDE

GO, GO, GRANNY

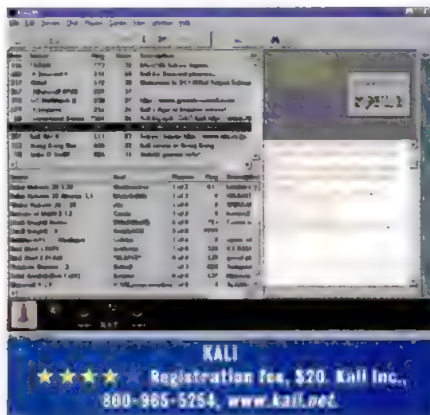
Hang on tight as Armed & Delirious takes you on a wild ride—with Granny at the helm. *Page 340.*



GIRL POWER

Barbie and Rockett promise hours of computer-based fun for your little girl. *Page 344.*

After Hours



gamer should be without it.

With a one-time registration fee of \$20, Kali is a bargain. Different versions are available for DOS, Macintosh, OS/2, and Windows 95 and NT, which makes it the only cross-platform service in this roundup. Unlike Heat.net and

Every time we logged on, there were at least 3,000 other players online. With a better interface and a broader selection of retail games, Internet Gaming Zone would be stronger.

Kali

Kali is more a software utility than an online gaming service. But it's so valuable that we feel no serious

Zone, which include IPX simulators, Kali is an IPX simulator. Kali "tricks" your computer into thinking it's attached to a local area network when it's actually dialed into the Internet. This feature allows you to play any game with IPX support over Kali—and most games that offer multiplayer support do so through IPX.

The interface is straightforward.



Kali offers little in the way of window dressing; you'll see a plain-text chat room when you log on to the service. Since Kali has over 180,000 registered users, we never had difficulty finding someone to play with.

The service does not offer player rankings or tournaments, but it does serve as host to a number of Internet ladders—player-run ranking systems with their own tournament play.

Online Gaming: Head To Head

YES NO

Basic membership

Additional costs

Operating systems supported

Web browser required

Direct dial-up

Number of POPs

Backbone provider

IPX simulator

Game Categories

Action

Strategy/War games

Adventure/Role playing

Simulations

Sports

Family/Classics

Special Features

Tournament play

Player rankings tracked

Player-to-player paging supported

E-mail available through service

N/A—Not applicable. The product does not have this feature.



Heat.net 1.2

Free

Premium membership, \$49.99 per year

Windows 95

Internet Explorer 3.0 or later or Navigator 3.0 or later

X

N/A

N/A

✓

✓

✓

✓

✓

X

X

X

✓

✓

✓

✓

✓

Internet Gaming Zone 3.1

Free

Direct dial-up access, \$0.99 per hour; Fighter Ace, \$19.95 per month

Windows 95

Internet Explorer 3.0 or later

✓

5

Dwango

✓

✓

✓

✓

✓

✓

✓

✓

X

X

(select games only)

✓

X

Kali 1.2

Registration fee, \$20

None

Windows 95 Windows NT, Mac OS, DOS, OS/2

None

X

N/A

N/A

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

X

Mplayer 1.35.177

Free

Mplayer Plus, \$39.95 per month

Windows 95

None

X

N/A

N/A

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

✓

X

TEN 1.3.1.4

3 months, \$39.90

Direct dial-up access, \$1.35 per hour

Windows 95

None

✓

350

Concentric

✓

✓

✓

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X

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A family reunion is scheduled to take place this Fall, thanks to Family Tree Maker. I never would have found my family if it weren't for the program.

Thank you!

Diana Yashar

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After Hours

Kali is cheap, reliable, and versatile. Simply put, it's an essential component of any serious game player's arsenal.

Mplayer

Mplayer has some outstanding qualities: a large user base and a variety of games in several categories. The service uses an awkward interface, however, and its performance can be quite choppy.

Mplayer works with Windows 95 and offers free basic membership. With this free access, you can play any game Mplayer offers if you own the game software. An Mplayer Plus membership costs \$39.95 per year and gives you access to more games and features. The service offers an assortment of games, ranging from MechWarrior 2 and Quake to Scrabble.

Accessing Mplayer can be a lengthy process, because the service goes through a series of software and system checks before allowing you to play any games. The chat interface is adequate, although it is not as intuitive as TEN's. Game

play via Mplayer is at times stellar, but it was plagued by lag and latency during many of our tests.

Mplayer hosts numerous tournaments, and as we went to press, the service was



rolling out a new player-ranking system for Quake. It's available for Mplayer Plus members only.

If it weren't for the choppy performance and the slow start-up time, Mplayer would be the ideal online gaming service. As it stands, you'll want to make sure you have some patience and a first-rate Internet connection before you sign up.

Total Entertainment Network

Despite early problems with latency and performance, Total Entertainment Network (TEN) has made huge strides toward becoming the premier gaming service. TEN has a wide selection of games, a dedicated user base, and an excellent front end.

At the time of this review, TEN was still charging its users \$19.95 per month or \$39.90 for 3 months. But TEN's new pricing structure will include free access to most

games, including Quake and Total Annihilation. Silver membership at \$9.95 per month will allow access to more games, including Duke Nukem 3D and Command & Conquer: Red Alert. Gold access (\$19.95 a month) will allow access to the Dark Sun role-playing games and NASCAR 2 Racing Online.

TEN's slick interface runs on Windows 95 and provides intuitive access to the service's chat rooms. Game play and performance over TEN were excellent. TEN offers the best player-ranking system of the group and hosts frequent tournaments. The service is also the home of the Professional Gamers' League (PGL).

At press time, TEN was beginning a beta test for Version 2.0 of its client software. This Java-based front end promises to speed up software updates—the service's one remaining (and glaring) weakness.

TEN's future looks bright. Even without the proposed changes, TEN is the best place for fast, reliable gaming on the Internet.

Five Great Net Games

For online fun without a total gaming service, we recommend the following games.

• Ultima Online

(\$55 street, \$9.95 a month; Origin Systems, www.ultimaonline.com.) Although occasionally slow, the game is great for online dragon slaying and socializing.

• You Don't Know Jack: The NetShow

(Free; Berkeley Systems, www.berzerk.com.) An online version of the trivia favorite, The NetShow offers a weekly dose of game-show fun with a huge helping of attitude.

• Command & Conquer: Sole Survivor Online

(\$30 street, no monthly fee; Westwood Studios, www.westwood.com.) An online version of the popular Command & Conquer series, Sole Survivor gives you free Internet play.

• Diablo

(\$50 street, no monthly fee; Blizzard Entertainment, www.blizzard.com.) This action-packed role-playing game still attracts more than 3,000 new players daily.

• Warbirds

(\$2 an hour; Interactive Magic, www.imagiconline.com.) Warbirds is the definitive game of aerial combat. Pick from World War II-era aircraft, then take to the virtual skies.—MER

GameStorm Rising

Online gaming giant Kesmai recently unveiled its plans for a promising new gaming service. GameStorm will offer Kesmai's classic games, including Air Warrior II, Aliens Online, and Legends of Kesmai, as well as integrated access to Heat.net and Engage! Games Online (another online gaming service). The service will cost \$9.95 for unlimited access (condensed into a single bill for all three services) and should be fully available by the time you read this.

The Kesmai games were already available as we went to press, so we were able to try out the slick new GameStorm client software. With plenty of games, automated software updates, e-mail and chat support, and even Web pages for its members, this new service looks impressive. If Kesmai can keep GameStorm on schedule, the service should become a major player in the online gaming community. Kesmai Corp., \$9.95 per month, www.gamestorm.com.—MER



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ACTION

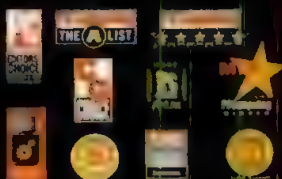
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DESIGN

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Granny's Revenge

The totally illogical becomes the norm in this wacky animated adventure.

Armed & Delirious

Armed commandos not quite your thing? Play **Armed & Delirious** and assume the role of Granny, a crabby senior citizen who lives in her family's attic. At least she did, until her house was torn apart by a mad rabbit bent on taking over the universe. Obviously this is no ordinary rabbit. He has bigger plans, too, such as using Granny's cookbook to make a pot of soup. It's up to Granny to save her family, but mostly she just wants to get her cookbook back.

With that beginning, you're launched on a mission spanning 5 bizarre planets and 14

locations. As Granny, you fly around the universe in a souped-up washing machine, collecting useful treasures and storing them in a bra of apparently limitless size. If you get far enough, you help a group of animated plants with their rebel assault on the rabbit. If they lose, they become part of his soup.

Pretty wacky, eh? That's just what **Armed & Delirious** has in mind. But although it strives to be the screwball game of the decade,

it trips over its own ambitions. Any game that wants to create its own loopy logic needs to work double time to make sure players don't get lost. And they will, with scores of puzzles that have only hit-or-miss solutions.

We were sorry to see this game go wrong, because it has so much going for it. The ani-

mation, reminiscent of Terry Gilliam's Monty Python work, is a treat. So are the inventive characters, which range from singing cows to feisty dominatrices. The jazzy, bluesy music also gets kudos.

In fact, so much excellent work has gone into these five Windows 95 CD-ROMs that

it's a pity more wasn't done to make the plot understandable.

Each screen presents a puzzle, but the goals are never clear. You end up clicking on objects simply because you can, not because you know what to do with them. How confusing is this game? We had a reviewers' guide to help us and we still had trouble with the puzzles. —Troy Dreier



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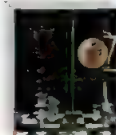


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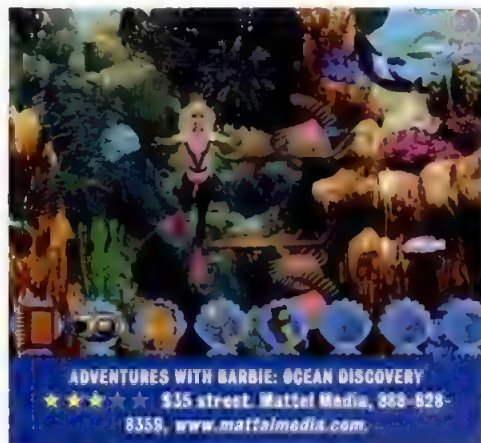
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Let's Hear It for the Girls

Creative and engaging, software designed for girls is opening up a whole new market.

By Kathryn F. Munro

A curious thing happens to many girls at around age 7. No, not their first crushes; it's that they begin to shy away from computers, leaving the shoot-'em-up games that dominate the market to the boys. In an effort to lure girls back to the PC, companies such as Mattel Media and Purple Moon are designing software specifically for girls. We tried three such programs.



Adventures with Barbie: Ocean Discovery

Adventures with Barbie: Ocean Discovery is Mattel Media's first adventure game starring the popular Barbie. Designed for girls aged 5 and up, the program focuses on creative-thinking skills and puzzle solving.

In the game, Barbie is a marine biologist searching for sunken treasure she needs to help save ocean life. She and your child are aided by Sandy the dolphin and Ken, Barbie's perennial boyfriend. A character named Captain Barnacle tries to thwart the mission.

The game's puzzles are challenging and may be a little tricky

for younger kids. Luckily, Barbie and Sandy give frequent clues and hints. Girls can replay each of the activities, which become increasingly difficult. The first time a puzzle is solved, a clue to saving the ocean is revealed. The next time your daughter plays the game and solves the puzzle, she wins a charm for Barbie's bracelet.

The game's graphics are attractive, and there's no scarcity of fun things to click on, including fish that change color and shape. Lip synchronization with the audio track is excellent and uncannily realistic—as it should be, since Barbie accomplishes her underwater feats with oxygen tanks on her back but no air mask. The adventure is saved in a scrapbook; at the end of the game, you can print out the entire quest.

Rockett's New School

The first game in Purple Moon's series of "friendship adventures" for girls from 8 to 12 years old, Rockett's New School invites kids along as Rockett Movado begins her first day as an eighth-grader at Whispering Pines Junior High.

Play begins with your child helping Rockett to navigate through the school while meeting new

friends and teachers. Throughout the game, girls are asked to make choices: how to act and whom to befriend. The choices determine how the story will progress and ultimately whether Rockett will have a good or bad day. The game has no rules and no right or wrong choices, and 45 different plot options ensure varied game play.

Rockett's New School presents issues that are important to girls in this age group, such as dealing with social cliques. The program gives girls the opportunity to explore and confront issues before they play them out in real life.

Girls can hear Rockett's thoughts about each situation and snoop through the contents of her backpack, which include diary entries and a photo album. Players can also investigate the lockers of other characters to gain insight into their lives. And once the story of Rockett's first day has been created, you can play it back as an animated movie.

Secret Paths in the Forest

Secret Paths in the Forest is a fantasy-based game featuring the same cast of charac-



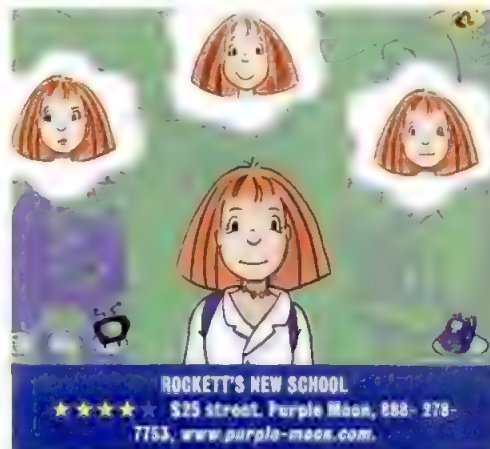
ters as in Rockett's New School.

Players are invited to a girls-only tree house. Once there, they meet seven girls, each of whom is dealing with a problem relating to family, friends, or emotions—a parents' divorce, for example. After listening to the girls, your child decides whom she'd like to help, then embarks on that girl's secret path. The paths run through an enchanted wilderness filled with challenging puzzles.

In order to help her new friend, a child must solve the puzzles and collect all of the magical stones hidden along the path. The stones are then strung together to create a necklace for the friend in need. When she receives it, a tale unfolds that gives her insight into understanding and solving her problem.

The secret tree house is also filled with surprises. A click on the "girls only" sign changes the look of the interior. Outside, the landscapes are lush yet somewhat vague, allowing girls to use their imaginations.

Secret Paths in the Forest helps girls understand that they are not alone with many of the fears and new emotions they are starting to experience. **PC**



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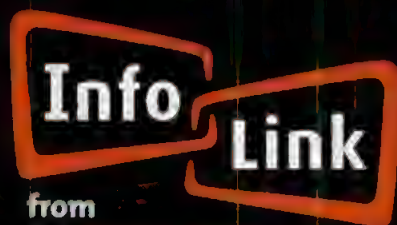
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Coming Up

What's in the Next Issue of PC Magazine

Utilities Guide for 1998

We're finishing our testing for *PC Magazine's* annual utilities blowout. This is the place to come for a complete roundup of all the latest and greatest utilities for your PC. Again this year, we cover the entire spectrum—and give you our take on which ones make up the essential handful, and how they all work together.

Desktop Utilities

We offer comparative reviews of the latest antivirus utilities, diagnostic and troubleshooting packages, backup software, program uninstallers, file viewers, and more. We also include a section on some great little utilities you'll want for your hardware—like programs to make printing go more smoothly.

Internet

Again this year we gather together lots of helpful utilities to make your connected time safer and more productive. We assess desktop security packages and parental filtering software, plus browser accelerators, instant messaging tools, search utilities, cookie managers, and more.



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*Call for leasing. Sorry but as prices are always changing, we do not offer price protection in the event prices rise or fall. Call for details and warranty information.

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DVD format!

A13-PC1	AMD K6-200 MMX PC Cinema		\$999.99
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PR200, P233 PCs: FROM \$499⁹⁹

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You can assemble a brand new multimedia 200 or 233 powerhouse
and save up to \$300! Choose just the right processor for your kind of
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easy? YES! In fact, you need only a screwdriver and about an
hour—it's easier to assemble than that barbecue on your patio!
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100% tested. Plus, the kit includes a top-speed 24X CD-ROM drive or
NEC 4-CD Changer, 56K BOCA Research faxmodem with voice, 16-
bit 3D Stereo Sound, S3 VIRGE 3D video with 4MB of video memory,

premium Windows 95 keyboard, PS/2
mouse, stereo speakers, microphone,
cables and more.

Tiger's top-of-the-line 233 and
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come with our finest AT or ATX mother-
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These new hard disks boost transfer rates
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- 4 PCI and 4 ISA Slots on ATX (4 PCI,
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Pre-installed and Tested

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Item #	Processor	MB	HD Support	Mouse	Price
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A13-KT 5	IBM 6x86MX P233	ATX	Ultra	IntelliMouse	\$679.99
A13-KT 6	AMD-K6 MMX 233MHz	ATX	Ultra	IntelliMouse	\$699.99
A13-KT 7	Pentium MMX 233MHz	ATX	Ultra	IntelliMouse	\$769.99
A13-KT 8	Pentium II MMX 266MHz	ATX	Ultra	IntelliMouse	\$1,049.99
A13-KT 9	Pentium II MMX 300MHz	ATX	Ultra	IntelliMouse	\$1,299.99

Add a Hard Drive. See below for specials.

Sorry, but as prices are always changing on CPUs, we do not offer price protection in the event prices rise or fall. Ask for details and warranty information. Configurations & prices subject to change; ask your sales rep for latest configurations & prices.

ADD MEMORY Kit includes 1 16MB DRAM DIMM

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Item #	Manufacturer	Capacity	Price	Item #	Manufacturer	Capacity	Price
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A13-HD 2B	Samsung UDMA	2.1GB	\$159.99	A13-HD 4A	Western Digital UDMA	4.3GB	\$239.99
A13-HD 3C	Seagate UDMA	3.2GB	\$209.99	A13-HD 6A	Western Digital UDMA	6.4GB	\$299.99

3.2 GB Ultra DMA HD Incredible Priced At Just \$169⁹⁹!

ITEM #	CAPACITY	INTERFACE	SEEK TIME	TRANSFER RATE	SPINDLE SPEED	BUFFER	BAY SIZE	WARRANTY	PRICE
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Western Digital Full Kit Maxtor Full Kit

ITEM #	CAPACITY	INTERFACE	SEEK TIME	PRICE	ITEM #	CAPACITY	INTERFACE	SEEK TIME	PRICE
W10-1136	3.1 GB	EIDE Mode 4	<12 msec	\$199.99*	M122-2005	4.3 GB	EIDE Mode 4	12 msec	\$249.99*
W10-1140	5.1 GB	Ultra DMA	<11 msec	\$249.99*	M122-2006	5.1 GB	EIDE Mode 4	10 msec	\$269.99*
W10-1142	6.4 GB	Ultra DMA	<9.5 msec	\$279.99*	M122-2010	8.4 GB	EIDE Mode 4	12 msec	\$419.99*

*Price after \$30 mail-in rebate. Effective 8/1/97 - 3/31/98.

*Price after \$30 manufacturer's mail-in rebate.

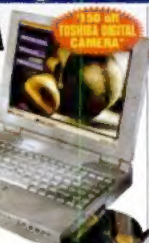
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Abort, Retry, Fail?

Error Message of the Year (So Far)

"Changes you have made recently online may not appear in the offline copy of your schedule file. These changes have been saved in the online copy and will be reflected in the offline copy the next time you work online. OK?"

—MICROSOFT SCHEDULE+

With DirectPC Turbo Internet™ Service™, you'll get the highest speed Internet access available nationwide, up to 400KPS!

Don't wait any longer—have information directly downloaded to a satellite on your roof and into your PC!

Well, let's hope it's not a big satellite. (Staples ad.)

Notes from the Police Blotter

"Oct. 20—Investigated report of theft of an Internet home page belonging to Service and Technology Group. After a check with federal authorities, STG was informed that no crime had been committed since the page wasn't copyrighted."—THE MILFORD (MASSACHUSETTS) CABINET



"On jeez! I hate when you fish out toasted chips with a butter knife!"

If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802. Winners this issue: Josh Itzkowitz, Marianne Kenny, Matt Poliano, Mark Seybold, Ian Ward, and Hal Wiedeman.



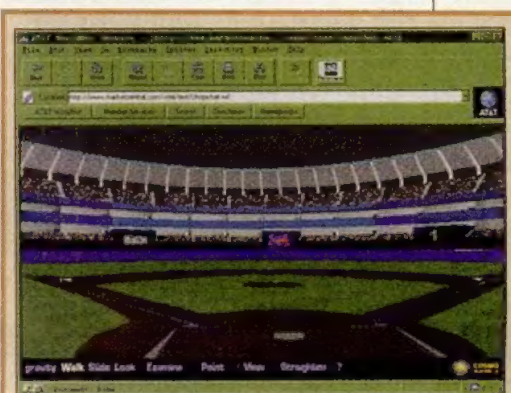
Micro-touch ouch Screen Monitor

That's one sensitive monitor. (System ID Warehouse catalog.)

Sony, the One and Only

We couldn't believe our eyes when we saw this one. Page 37 of the instruction manual for the Sony Mavica FD-7 digital camera discusses Beach & Ski Mode—"For people or faces in strong light or reflected light, such as at a beach in midsummer or on a ski slope." Three pages later, the manual says, "This camera's operational temperature is between 32 to 104 degrees. Do not use this camera in extreme climates such as that of a hot beach or a skiing resort."

It's the only way to navigate through Fulton County Stadium, which was demolished in 1997. (PC Magazine.)



The Web also will deliver more 3-D content. Look for 3-D home worlds—virtual malls, model houses, and places of interest that you can navigate through, such as Fulton County Stadium.

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